# MONEY NEUTRALIZATION AND THE BALANCE OF PAYMENTS OF NORWAY

By

KAREN JUNKER OHLDIECK

A DISSERTATION PRESENTED TO THE GRADUATE COUNCIL OF
THE UNIVERSITY OF FLORIDA
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
DEGREE OF DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

1977

ACKNOWLEDGEMENTS

I would like to sincerely thank all of those who have offered their help during my work with this dissertation. In particular, I would like to thank the members of my Ph.D. supervisory committee. My chairman, Dr. Michael B. Connolly offered invaluable guidance and encouragement through the entire work. Special thanks must also be given to Roger D. Blair, who, in addition to guidance on the contents, put in a lot of effort and time improving and correcting my English language. I also want to express my appreciation to Yvonne Robertson, who typed the final draft my dissertation. While I wish to acknowledge my great indebtness to those who helped me, I alone am responsible for whatever errors that might remain.

CONTENTS


Page

ACKNOWLEDGEMENTS..... ii

LIST OF TABLES..... v

ABSTRACT..... vi

CHAPTER I

INTRODUCTION AND SUMMARY..... 1
Introduction..... 1
Macroeconomic Development in Norway..... 2
The Monetary Model and Review of Empirical Studies: The Monetary Model..... 2
Short Review of Some Empirical Studies..... 4
The Integrated Market Hypothesis..... 7
The Monetary Model: Empirical Results..... 12
Estimation Results..... 14
Simultaneous Equation Model..... 26
Conclusions..... 29
Notes..... 30

CHAPTER II

GENERAL MACROECONOMIC DEVELOPMENT IN NORWAY DURING THE PERIOD 1955-1970..... 31
Monetary Policy in Norway: 1955-1970..... 34
Monetary Policy: 1955-1965..... 34
Monetary Policy: 1965-1970..... 37
Short Explanation of the Norwegian Bank System's Institutions..... 38
Notes..... 43

CHAPTER III

BALANCE OF PAYMENTS APPROACHES, HISTORY, THEORY AND A LITERATURE REVIEW OF THE MONETARY APPROACH..... 47
Brief History of the Development of the Balance of Payments Theory..... 47
A Short Review of the Three Different Approaches to the Balance of Payments Analysis..... 48

Page

The Elasticity Approach..... 48
The Absorption Approach..... 49
The Monetary Approach..... 49
Review of Some Empirical Studies of the Monetary Approach to the Balance of Payments..... 52

CHAPTER IV

THE INTEGRATED MARKET HYPOTHESIS, THEORETICAL MODEL AND EMPIRICAL RESULTS..... 60
Theoretical Development and Review of Some Empirical Studies..... 60
The Integrated Market Hypothesis: Empirical Results.... 66
Notes..... 74

CHAPTER V

THE MONETARY MODEL: THEORY AND EMPIRICAL RESULTS..... 75
1. Single Equation Model..... 75
2. Single Equation Model Explicitly Incorporating World Monetary Equilibrium..... 78
Reserve Flow Equations: Empirical Results..... 80
Single Equation Estimates with Special Attention to the Shipping Sector..... 92
Single Equation Estimates: Explicitly Introducing World Relations..... 97
Single Equation Estimates: Introducing the World Price Level..... 106
Single Equation Model: Testing for Possible Effects of the 1967 Devaluations by Some of Norway's Major Trade Partners..... 108
Notes..... 118

CHAPTER VI

A SIMULTANEOUS EQUATION MODEL FOR THE RESERVE FLOW..... 122
Notes..... 128

APPENDIX I

A SHORT REVIEW OF THE HISTORY OF THE NORWEGIAN BANK SYSTEM..... 129
Notes..... 135

APPENDIX II

RESULTS FROM THE ESTIMATION OF THE RESERVE FLOW EQUATIONS INCLUDING A CONSTANT TERM..... 137

APPENDIX III

THE LAW CONCERNING THE AUTHORITY TO REGULATE MONETARY AND CREDIT CONDITIONS..... 145

Page

REFERENCES..... 160

BIOGRAPHICAL SKETCH..... 163

LIST OF TABLES


| | | Page |
|---|---|---|
| TABLE IV.1 | WEIGHTS OF MAJOR TRADE COUNTRIES' EXPORTS AND IMPORTS WITH NORWAY..... | 64 |
| TABLE V.I | IMPORTS AND EXPORT SHARES..... | 117 |

Abstract of Dissertation Presented to the Graduate Council
of the University of Florida in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

MONEY NEUTRALIZATION AND THE BALANCE OF PAYMENTS OF NORWAY

By

Karen Junker Ohldieck

August 1977

Chairman: Michael B. Connolly
Major Department: Economics

The monetary approach to the balance of payments theory is applied to the Norwegian experience for the time period 1955 to 1970. The objective of the study is: (1) to test the integrated market hypothesis for goods market; (2) to test the basic monetary model of the balance of payments; (3) to determine whether the development within one of the major market sectors had any influence on the reserve flow model; (4) to determine whether the 1967 devaluations had any influence on the Norwegian reserve flow; (5) to determine whether explicitly incorporating world monetary equilibrium provides additional information; and (6) to investigate whether the Norwegian monetary authorities have acted so as to sterilize the change in international reserves in order to keep a stable money supply.

The period 1955 to 1970 was a stable period for the Norwegian economy, the country was on a fixed exchange rate system and no

devaluations took place. The rate of growth in the gross national product was high and there existed a high demand during most of the years. The integrated market hypothesis, which postulates that the rate of inflation is equal across countries, was tested since it is one of the assumptions of the monetary model. The model used to test this hypothesis was an ordinary least squares regression model of the Norwegian price inflation on the world price inflation and a constant. The prediction of the theory is that the constant is zero and the coefficient for the world inflation + 1.0. These hypotheses could not be rejected at the .05 level of significance. The basic monetary model of the balance of payments defines international reserve flow as a function of income, price, interest rate and domestic credit creation. The predicted values of these coefficients are + 1.0, + 1.0, negative, and - 1.0, respectively. This model was tested for the time period 1955 to 1970 as well as for the subperiod 1955 to 1965. Income is introduced alternatively as permanent income or as current income and the price variable is defined alternatively as the Norwegian price inflation or the world price inflation. The model is further tested for money both narrowly and broadly defined. The estimation results indicate that the narrow definition of money yields the best results. The different definitions of the other variables brought about small changes in the coefficients and in explanatory power. The estimation results provide some support for the monetary model.

The monetary model predicts that the development within any particular sector will not affect the reserve flow. To test this the growth rate of foreign shipping capital transactions was entered as an explanatory variable. The empirical results yielded a coefficient for this variable that was not significantly different from zero; thus providing further support for the hypothesis.

In 1967, several of Norway's major trade partners devalued. To test whether this had any effect on the Norwegian development, a time dummy variable was introduced into the model. The predicted sign of this variable is negative. The estimation yielded a statistically insignificant coefficient.

World monetary equilibrium was incorporated, where the exogenously determined domestic price and interest rate variables are functions of foreign credit creation and foreign income growth. The estimation showed these world variables to be a good measure of the price and interest rate variables.

The sterilization hypothesis was tested using a two-stage least squares estimation of domestic credit creation on the growth of international reserves. In addition, the institutional evidence was examined. The conclusion was that the sterilization hypothesis does not receive any support during this period.

# CHAPTER I

# INTRODUCTION AND SUMMARY

## Introduction

In this study, the monetary approach to the balance of payments theory is applied to the Norwegian experience for the time period 1955 to 1970. The objective of the study is:

1. To test the integrated market hypothesis for the goods market;
2. To test the basic monetary model of the balance of payments;
3. To determine whether the development within one of the major market sectors had any influence on the reserve flow model;
4. To determine whether the 1967 devaluations had any influence on the Norwegian reserve flow;
5. To determine whether explicitly incorporating world monetary equilibrium provides additional information; and
6. To investigate whether the Norwegian monetary authorities have acted so as to sterilize the change in international reserves in order to keep a stable money supply.

Chapter II gives some relevant institutional and historical background on Norway's macroeconomic development, monetary policy and monetary institutions. Chapter III deals briefly with the history and theoretical developments of the balance of payments theory as well as providing more detailed discussion of some of the empirical studies on the monetary approach to the balance of payments. Chapter IV discusses the empirical testing of the integrated market hypothesis and Chapter V treats the

empirical results of the estimation of the various reserve flow models. Chapter VI deals with the neutralization policy question.

The empirical results support the integrated market hypothesis. The support for the monetary model of the reserve flow is not that strong, but the central domestic credit variable is in most cases fairly close to its expected value of -1.0. Finally, the neutralization hypothesis receives no support for the case of Norway during this period.

## Macroeconomic Development in Norway

The period 1955 to 1970 was a stable period with no extraordinary influences on the economy. The exchange rate did not change at all during this period. Norway experienced an annual rate of growth in the gross national product of 7.8%,[1] there existed in most of the years a high demand pressure and investment in fixed real capital was high.[2] The balance on the current account was negative in most years, but capital import more than exceeded this deficit. Thus, Norway experienced a steady growth in international reserves in all but three of the years.[3] Prices have been steadily increasing; measured by the consumer price index, the rate of inflation was at an annual average of 3.4%.[4]

## The Monetary Model and Review of Empirical Studies: The Monetary Model

The basic monetary model of the balance of payments was developed by Johnson in his article, "The Monetary Approach to Balance of Payments Theory." (18, 1976). This model, which is the starting point for most of the further studies in this area, builds on the following assumptions:

1. The adjustment mechanism is instantaneous such that money demand equals money supply.
2. The purchasing power parity holds.

3. The interest rate parity holds.

4. The economy is in a state of full employment.

The demand for money is defined as a function of income and interest rate.

(1.1) $M_d = p\, f(Y,i)$

where:

$M_d$ = the demand for money

$p$ = the price level, no subscript necessary since home and foreign price levels are equal by assumption 2.

$Y$ = income

$i$ = interest rate

It is further assumed that the demand for money is homogeneous of degree one in prices. The money supply function is defined as:

(1.2) $M_s = R + D$

where:

$M_s$ = the supply of money

$R$ = international reserves

$D$ = domestic credit

Using assumption 1, we can equate money supply and money demand, and rearranging the terms we have:

(1.3) $R = M_d - D$

We now substitute from equation (1.1) the expression for $M_d$, rewrite in terms of logs and totally differentiate; then in terms of rates of growth, we will get the following:

(1.4) $g_R = \frac{1}{r}(g_p + n_y g_y + n_i g_i) - \frac{1-r}{r} g_D$

where:

$g_R$ = the rate of growth of international reserves

$g_p$ = the rate of growth of prices

$g_Y$ = the rate of growth of income

$g_i$ = the rate of growth of interest rates

$g_D$ = the rate of growth of domestic credit

$r = \frac{R}{M_s} = \frac{R}{M_d}$

$n_Y$ = the elasticity of income

$n_i$ = the elasticity of interest rates

Equation (1.4) expresses the basic monetary relationship between the growth in reserves and the explanatory variables. We note that there is expected to be an inverse relationship between the growth in reserves and the growth in domestic credit. This basic model has been extended in several ways and some of these extensions will be dealt with in connection with the empirical studies.

Short Review of Some Empirical Studies

Since all of the empirical studies build on the basic monetary model described above this will not be repeated for the different studies. Instead, weight will be placed on the deviations from and extensions of that basic model.

Zecher (27, 1976) studied the case of Australia for the period 1950 to 1971. His model is very close to that outlined earlier and the estimated reserve flow equation is:

$$(1.5) \qquad \left(\frac{R}{H}\right) g_R = a_1 g_Y - a_2 g_i + b_1 g_p - b_2 g_a - b_3 \left(\frac{D}{H}\right) g_D + e$$

where:

$H = R + D$

$a$ = the money multiplier

$e$ = stochastic error term

Equation (1.5) was estimated using quarterly, semiannual and annual data. In all cases, the estimates supported the monetary model, i.e., he could not reject the hypothesis at the .05 level of significance that the coefficiencts had their expected values, which are + 1.0 for the price and income variables and - 1.0 for the domestic credit and multiplier variables.

Genberg (14, 1976)) studied the monetary approach for the case of Sweden, he concluded that his estimates supported the monetary model. In addition to estimating the basic reserve flow equation, Genberg tested the integrated market hypothesis for the goods and capital sectors. He accepted the unified market hypothesis for both markets. For the reserve flow equation, he distinguished between the short-run and the long-run money demand functions. The short-run demand function is defined as a lagged adjustment process between the desired and the actual demand in the preceding period. The long-run demand function is defined as a function of income and interest rate. Genberg also dealt with the possibility of a simultaneous equation bias in the reserve flow estimates as a result of domestic credit being a function of international reserves. To test for this possibility he developed a simultaneous equation model where domestic credit is a function of international reserves and government debt outstanding. The reserve

function is the same as that developed for the single equation estimation. He did not find any conclusive evidence to support the sterilization hypothesis. The reaction function defined was not adequate, but the expected values for the reserve flow equation were still obtained.

Bean (2, 1976) and Guitian (15, 1976) used the basic monetary model for the balance of payments; Bean for the case of Japan and Guitian for the case of Spain. Bean's study strongly supported the monetary approach, while the support was rather weak in the study of Spain.

The basic monetary model has been extended to explicitly include world monetary equilibrium. The studies by Cox and Wilford (8, 1976) and by Cox (7, 1976) are examples of this extension. In this extended model, the growth rate of the foreign credit creation and the growth rate of foreign-determined price and interest rate variables. This model was tested for the cases of Mexico and Canada and the results supported the monetary model. The study by Cox (7, 1976) extended this model even further by building into the model uncertainty about the foreign variables. This uncertainty is then modeled through a rational expectations model. The results of incorporating this uncertainty into the model were not too noticeable as the estimation results were very close to those obtained in the other models.

The above mentioned studies all used time-series data in the estimation, the monetary approach has, however, also been tested using cross-sectional data. Connolly and Taylor (5, 1975) used data from 17 developing and 10 developed countries in their study of the effect of a devaluation on the balance of payments. The estimated equation was:

$$(1.6) \qquad \left(\frac{B_t}{M_t} - \frac{B_{t-1}}{M_{t-1}}\right) = b_1 \frac{r_t}{r_t} + b_2\left(\frac{D_t}{M_t} - \frac{D_{t-1}}{M_{t-1}}\right) = U$$

where:

B = balance of payments,

r = the exchange rate,

and the rest of the variables are defined above.

They found that a devaluation does improve the balance of payments and they could not reject the hypothesis that the coefficient of domestic credit is - 1.0. This study also dealt with the possibility of a simultaneous equation bias in the estimates as a result of domestic credit being a function of reserves as well as the other way around. The result of the test was that the sterilization hypothesis could not be rejected for the sample of developed countries, but it had to be rejected for the sample of developing countries. Connolly and Taylor (6, 1976) conducted another cross-sectional study using data from 18 independent devaluations in the period 1959 to 1970. The results of this study fail to reject the hypothesis of the domestic credit variable's being - 1.0, but the hypothesis of the coefficient for the rate of devaluation being greater than + 1.0 had to be rejected. Genberg (13, 1974) used a model similar to that used by Connolly and Taylor (6, 1975), but he allowed the price level to adjust slowly to the new level implied by the purchasing power parity. He used data from 17 countries and he concluded that the domestic credit variable entered with its expected value.

The Integrated Market Hypothesis

One of the assumptions of the basic monetary model is that the integrated market hypothesis holds. This question has been studied by Genberg (14, 1976) and Bordo and Choudhri (3, 1976), these studies reached different conclusions. Genberg, studying the case of Sweden,

accepted the integrated market hypothesis, while Bordo and Choudhri, studying the case of Canada rejected the hypothesis. The models used to test the hypothesis differed in the two studies, and a brief discussion of these models will follow later. The integrated market hypothesis in its simplest form is expressed by the purchasing power parity in its absolute form. When we allow for the presence of import and/or export taxes and subsidies, however, the hypothesis has to be expressed by the relative version of the purchasing power parity:

$$(1.7) \quad \frac{\Delta p}{p} = \frac{\Delta p^*}{p^*} e$$

where:

$p$ = home price

$p^*$ = foreign price

$e$ = exchange rate

Equation (1.7) tells that the rates of inflation in the different countries will be the same. The model builds on the simplifying assumptions (a) that all goods are traded, (b) if we are using an aggregate price index, that the weighing schemes are equal and (c) that there is no change in tariffs or other trade barriers.

Genberg (14, 1976) tested this integrated market hypothesis for Sweden using different approaches:

1. He compared the differences in inflation rates for the OECD countries with the difference in inflation rates between different US cities. He found that there was just as much variation between the US cities as between the OECD countries, and he claims that this justifies regarding the OECD countries as one market.

2. He regressed the Swedish rate of inflation on the world rate of inflation, using an average of 15 other countries' rates of inflation as the measure of world inflation. He had to

reject the hypothesis that the coefficient of world inflation was + 1.0 as predicted by the model.

But in spite of this result, he concludes that the integrated market hypothesis cannot be rejected for the case of Sweden. In contrast, Bordo and Choudhri (3, 1976) looked at the price correspondence for selected commodity groups instead of for the aggregate price index. They developed two models, one for the short-run and one for the long-run. In the the short-run, the purchasing power parity is expected to hold for traded goods only. In the long-run model, the ratio of the home and foreign price is expected to tend to a constant mean value. They rejected the integrated market hypothesis for most of the commodity groups.

The model used for testing the integrated market hypothesis in this study is the second method used by Genberg (14, 1976), i.e., the Norwegian price inflation is defined as a function of the world price level. The measure used for the Norwegian price level is the consumer price index, which contains both traded and nontraded goods. But for the case of Norway, the nontraded goods sector is rather small. It is a larger drawback with this measure that several of the components have been subject to heavily changing trade restrictions. In spite of these difficulties, the consumer price index appears to be the best available measure. The integrated market model will then be:

(1.8) $g_p = a_0 + a_1$ World inflation rate + u

where:

$g_p$ = the Norwegian inflation rate

u = stochastic error term

Since Norway does not have one single major trade partner, a measure of world inflation had to be constructed. Two different definitions of

world inflation were constructed. The first is a weighted average of the inflation rates in the 10 countries that are Norway's major trade partners. The individual weights are each country's share of trade with Norway. The second measure is the corresponding unweighted average of these same countries' inflation rates. The weighted variable is defined as:

(1.9) WINF = ((CPID * 8.4) + (CPIS * 24.0) + CPIGB * 19.6) +
(CPIWG * 20.8) + CPIUS * 8.6) + (CPIC * 4.6) +
(CPIF * 3.9) + (CPII * 2.8) + (CPIH * 4.2) +
(CPIFI * 3.1))/100

The unweighted measure is defined as:

(1.10) WI = (CPID + CPIS + CPIGB + CPIWG + CPIUS + CPIG + CPIF +
CPII + CPIH + CPIFI)/10

where:

WINF = the weighted rate of world inflation
WI = the unweighted rate of world inflation
CPID = the rate of inflation in Denmark
CPIS = the rate of inflation in Sweden
CPIGB = the rate of inflation in the United Kingdom
CPIWG = the rate of inflation in West Germany
CPIUS = the rate of inflation in the United States
CPIC = the rate of inflation in Canada
CPIF = the rate of inflation in France
CPII = the rate of inflation in Italy
CPIH = the rate of inflation in the Netherlands
CPIFI = the rate of inflation in Finland

The estimation of equation (1.8) using definition (1.9) of world inflation, for the time period 1955 to 1970 yielded the following estimates:

$$(1.11) \quad g_p = -.008 + 1.35\ WINF$$
$$\qquad\qquad\quad (.02) \quad (.41)$$
$$R^2 = .45$$
$$\text{Durbin-Watson statistic} = 2.28$$

The standard errors of the estimates are reported in parentheses underneath the coefficients. The integrated market hypothesis predicts a value of zero for the constant term, and we cannot reject this hypothesis at the .05 level of significance. The coefficient for world inflation, according to the integrated market hypothesis, should be + 1.0. Since the estimated coefficient is 1.35 and has a standard error of .41, we cannot reject this hypothesis at the .05 level of significance. The hypothesis of no autocorrelation cannot be rejected at the same significance level. Equation (1.8) was also estimated using the unweighted measure of world inflation, which changed the quantitative results very little and the hypothesis testing led to the same conclusions. The $R^2$ for this last estimation was somewhat lower than the $R^2$ obtained for equation (1.11).

Equation (1.8) was estimated for the time period 1955 to 1965, using definition (1.9) of world inflation. The following results were obtained:

$$(1.12) \quad g_p = .006 + .89\ WINF$$
$$\qquad\qquad\quad (.02) \quad (.48)$$
$$R^2 = .31$$
$$\text{Durbin-Watson statistic} = 2.07$$

We cannot reject the hypothesis of the constant's being zero or the hypothesis of the world inflation rate being + 1.0 at the .05 level of significance. The same conclusions were reached using the unweighted measure of world inflation. The estimation results seems to strongly support the integrated market hypothesis for the case of Norway. This conclusion is the same if the test is based on the whole period or on the subperiod 1955 to 1965.

## The Monetary Model: Empirical Results

### The Model

The Model developed and estimated for the reserve flow equation, builds on the monetary model developed by Johnson, and makes the same assumptions. The money supply is defined as:

(1.13) $M_s = R + D_i$

where the i subscript is 1 if money is narrowly defined and 2 if money is broadly defined. The demand for money function is assumed to be homogeneous of degree one in prices and is defined as:

(1.14) $M_d = p\ f(Y,i)$

where the variables are as defined earlier.

Equating money supply and money demand, rearranging the terms, differentiating the equation logarithmically and expressing everything in growth terms yields the the following relationship:

(1.15) $\left(\frac{R}{R+D_i}\right) g_R = a_1 g_p + a_2 g_Y + a_3 g_i - a_4 \left(\frac{D_i}{R+D_i}\right) g_{D_i} + e$

where:

e = the stochastic error term and

all other variables are as earlier defined.

Equation (1.15) is the model that will be used for testing the monetary approach, and it will be referred to as the basic equation.

The Monetary Model Explicitly Incorporating World Monetary Equilibrium

As mentioned in the literature review, the monetary model has been extended to explicitly incorporate world monetary equilibrium. The model used in this study builds on the model developed by Cox and Wilford (8, 1976). If we denote the home country with the subscript z and the rest of the world by the subscript f, we have the following relationships for the home country:

(1.16) $M_d(z) = p(z)\, f_z\,(Y(z), i(z))$

(1.17) $M_s(z) = R(z) + D_i(z)$

(1.18) $M_s(z) = M_d(z)$

We keep the assumptions of interest rate and purchasing power parity. For the rest of the world, corresponding relationships hold as for the home country, and the equilibrium conditions for the whole world are obtained by adding the relationships for the home country and the rest of the world. Manipulating these relationships, making use of the small country assumption, and assuming no growth in reserves world wide yields the following reserves flow equation:

$$(1.19)\quad \frac{R(z)}{Mi(z)}\, g_{R(z)} = a_2 g_{Y(z)} - b_2 g_{Y(f)} + \frac{D_i(f)}{Mi(f)}\, g_{D_i(f)} + a_4 \frac{D_i(z)}{Mi(z)}\, g_{D_i(z)} + e'$$

where all the variables are as earlier defined.

The relationship between the exogenously determined price and interest rate variables and the foreign income and credit creation variables is:

$$(1.20) \quad g_{p(z)} + b_3 g_{i(z)} = - b_2 g_{Y(f)} + \frac{D_i(f)}{Mi(f)} g_{D_i(f)}$$

Equation (1.19) and slight variations of this relationship were estimated for the case of Norway.

Estimation Results

Single Equation Estimates: Basic Equation

The basic equation is given by:

$$(1.21) \quad \left(\frac{R}{R+D}\right) g_R + a_1 g_p + a_2 g_Y + a_3 g_i + a_4 \left(\frac{D_i}{R+D_i}\right) g_{D_i} + e$$

Data for the estimation are take from International Financial Statistics (17). The price variable is in most of the models measured by the domestic consumer price movement. In one part of the study, the world rate of inflation is used for this variable. Two measures are used for the income variables. Most of the equations use permanent income, calculated as a moving five-year average of the real gross national product in Norway. The other measure, which is used in only one part of the study, is current income. The interest rate variable is measured by the government bond rate. Two different measures are used for the domestic credit variable, one building on the narrow definition of money and the other on the broad definition of money. The monetary model leads to the following predictions for the coefficients in the reserve flow model (1.21): the value of $a_1 = a_2 = + 1.0$, the value of $a_4 = - 1.0$ and the value of $a_3$ negative. This basic equation has been estimated for two different time periods and for the different definitions for the variables.

Estimation of equation (1.21) for the period 1955 to 1970 using the narrow definition of money and permanent income yielded the following results:

$$(1.22)\quad \frac{R}{M1}\, g_R = \underset{(.25)}{.64}\, g_Y - \underset{(.08)}{.02}\, g_i + \underset{(.46)}{.17}\, g_p - \underset{(.16)}{.65}\, \frac{D_i}{M1}\, g_{D_1}$$

$$R^2 = .65$$

Durbin-Watson statistic = 1.90

The coefficient of permanent income of .64 and the coefficient of price inflation of .17 are not significantly different from their expected value of + 1.0 at the .05 level of significance. The interest rate variable is negative as expected, but it is very low and has a large standard error. Thus, it is not significantly different from zero at the same significance level. The domestic credit variable enters with a coefficient of - .65 and a standard error of .16. Thus, we have to reject the hypothesis of this coefficient's being - 1.0 at the .05 level of significance. The confidence interval for this variable is (-.33, -.97) and is close to covering the hypothesized value. The joint hypothesis that the income, price and domestic credit variable simultaneously obtain their expected values was tested for the above equation. The null hypothesis is:

$$H_0 : a_1 = +1.0,\ a_2 = +1.0,\ a_4 = -1.0$$

against:

$$H_1 : a_1 \neq +1.0,\ a_2 \neq +1.0,\ a_4 \neq -1.0$$

To carry out this test, we have to make use of the fact that:[5]

$$F = \frac{(RRSS - URSS)/R}{URSS/n-k}$$

where:

RRSS = restricted residual sum of squares

URSS = unrestricted residual sum of squares

R = number of linear restrictions

n = number of observations

k = number of parameters

has an F distribution with degrees of freedom R,n-k.

The calculated F value for model (1.22) is 14.67. From the tables, we find that the nonrejection region at the .10 significance level is ($.28 < F < 3.71$), which implies that we have to reject the hypothesis that the three variables simultaneously obtain their hypothesized values at this significanct level. The Durbin-Watson statistic implies that we cannot reject the hypothesis of no autocorrelation at the .05 level of significant. Equation (1.21) was estimated for the same time period, 1955 to 1970, using the broad definition of money. This estimation was carried out due to prior expectations that this measure would do better for the case of Norway. The reason for this expectation being that there is no clear cut distinction between demand and time deposits in Norway, as there exist interest bearing checking accounts. The estimation of (1.21) using the broad definition of money, did not support this expectation. The estimated coefficients were further away from their expected values and the explanatory power of the equation, measured by $R^2$, was about half that obtained using the narrow definition of money. Based on these findings, the narrow definition of money will be used throughout the rest of this study. Arguments can be made for using either permanent or current income in the reserve flow equation. Thus, the basic equation (1.21) was reestimated for the period 1955 to 1970 using current income. The following results were

obtained:

$$(1.23)\quad \frac{R}{M1} \underset{(.23)}{g_R} + .27\, g_Y - .03\, g_i + \underset{(.43)}{.78\, g_p} - \underset{(.18)}{.56\, \frac{D_1}{M1}\, g_{D_1}}$$

$R^2 = .48$

Durbin-Watson statistic = 1.87

We have to reject the hypothesis of the income variable's coefficient being + 1.0 and the hypothesis of the domestic credit variable's being - 1.0 at the .05 level of significance. Since price variable is .78 and it has a standard error of .43, we cannot reject the hypothesis that this coefficient is + 1.0 at the same level of significance. The interest rate variable is not significantly different from zero at the .05 level of significance, but it enters with its expected negative sign. Compared with the equation using permanent income (1.22), we note that the income coefficient is further away from its expected value and leads to rejection of the null hypothesis, whereas we could not reject the corresponding hypothesis for equation (1.22). The price variable in equation (1.23) is closer to its predicted value of + 1.0, but in both cases the null hypothesis could not be rejected. The domestic credit variable failed in both cases to confirm the hypothesis of its being - 1.0 at the .05 level of significance. The explanatory power decreased from equation (1.22) to equation (1.23). Based on the preceding comparisons, it is not possible to definitely rank one of the measures of income above the other, but in the rest of this study the the permanent income measure will be used.

The change in political power together with the change in the organizational structure of the implementation of monetary policy in

Norway in 1965 led to the hypothesis that there might have been a structural shift in the reserve flow equation at that time. The change in political power was a shift from a socialistic to a nonsocialistic government. Interestingly, this turned out to be of minor importance, as the new government continued to conduct a policy very similar to that conducted by the socialistic government. The other major change was the introduction of the "Law concerning the Authority to Regulate Monetary and Credit Conditions." This Law gave wide discretionary power to the government, and it signaled the end to the Joint Consultation Council and the implementation of monetary policy by agreement. Of the policy instruments made available to the authorities by this new law, the most widely used instrument in the following years was the reserve requirement. Based on this possibility of a structural shift, equation (1.21) was estimated for the period 1955 to 1965 using permanent income. The estimation yielded the following result:

$$(1.24)\quad \underset{}{\frac{R}{M1}\, g_R} + \underset{(.25)}{1.10\, g_Y} - \underset{(.05)}{.05\, g_i} - \underset{(.48)}{.92\, g_p} - \underset{(.14)}{.89\, \frac{D_1}{M1}\, g_{D_1}}$$

$$R^2 = .88$$

Durbin-Watson statistic = 2.25

The income variable and the domestic credit variable have coefficients and standard errors which imply nonrejection of the respective hypotheses that the income coefficient is + 1.0 and the domestic credit coefficient is - 1.0, at the .05 level of significance. The hypothesis of a coefficient of + 1.0 of the price variable has to be rejected at the same significance level. The interest rate variable is negative, but not significantly different from zero at the .05 level of significance.

To test if there were a structural change in 1965, we use the Chow test, which is a test for stability of coefficients.[6] To conduct this test, we need to run three regressions, one for the whole period 1955 to 1970 and one for each subperiod 1955 to 1965 and 1965 to 1970. The null hypothesis is that the coefficients are simultaneously equal for each of the variables. The following F test can then be applied:

$$F = \frac{(RRSS - URSS)/ (k+1)}{URSS/ (m_1 + m_2 - 2k - 2}$$

where:

$m_1$ = number of pbservations in subperiod 1

$m_2$ = number of observations in subperiod 2

The rest of the symbols as defined earlier.

The ratio has an F distribution with degrees of freedom

$(k + 1)$, $(m_1 + m_2 - 2k - 2)$.

The calculated F value is here 29.6, which implies that we cannot reject the null hypothesis that the coefficients are stable at the .05 significance level. This result supports estimating the model for the whole time period.

Single Equation Estimates With Special Attention to the Shipping Sector

The monetary model predicts that changes within a specific sector of the economy will have no effect on the reserve flow as long as it does not influence the demand for money. Changes within a sector will then be offset by changes in other sectors, leaving the reserve flow unchanged. To test this hypothesis, the growth rate of capital transactions connected with the Norwegian shipping industry were introduced into the reserve flow model as an explanatory variable. The reason for choosing this sector is its large size relative to the Norwegian

economy and also its close connection with the international capital market. The new model is:

$$(1.25) \quad \frac{R}{M1} g_R = a_1 g_Y + a_2 g_i + a_3 g_p + a_4 g_s + a_5 \frac{D_1}{M1} g_{D_i} + u$$

where:

$g_s$ = the growth rate of net shipping captial transactions, Net captial transactions = Direct foreign loans for shipping + commercial loans for shipping purchases - repayments on shipping loans - change in prepayments on ships.

$u$ = stochastic error term

Data for calculationg the growth rate of net shipping captial transactions come from Statistisk Aarbok (22). Equation (1.25) was estimated for the time period 1955 to 1970 and the following results were obtained:

$$(1.26) \quad \frac{R}{M1} g_R = .61\, g_Y - .02\, g_i + .26\, g_p - .0017\, g_s - .62\, \frac{D_1}{M1} g_{D_1}$$

$R^2 = .65$

Durbin-Watson statistic = 2.06

The hypothesis of the income and the price variables separately obtaining their hypothesized values cannot be rejected at the .05 significance level. The domestic credit variable enters with a coefficient of -.62 and a standard error of .16. Thus, we have to reject the hypothesis of this variable's being - 1.0 at the .05 level of significance. The shipping variable, $g_s$, enters with a low coefficient of .0016 and a standard error of .0022, which makes it not significantly different from zero at the .05 level of significance. The $R^2$ increased only marginally with the inclusion of the new variable. This result conforms to the predictions by the monetary model that this variable would have no effect on the reserve flow.

Single Equation Estimates Introducing the World Price Level

The monetary model builds on the assumption that the integrated market hypothesis holds, which implies that the Norwegian and the world rate of inflation is the same. It should therefore be irrelevant which of these measures are used in the reserve flow equation. In the model estimated here, the world rate of inflation is entered instead of the Norwegian rate of inflation. The estimated model is:

$$(1.27)\quad \frac{R}{M1}\, g_R + a_1 g_Y + a_2 g_i + a_3 WINF + a_4 \frac{D_1}{M1}\, g_{D_1}$$

where:

WINF = the world inflation rate, defined by equation (1.9)

Estimation of equation (1.27) for the period 1955 to 1970 yielded the following estimates:

$$(1.28)\quad \underset{(.48)}{\frac{R}{M1}\, g_R} + \underset{(.09)}{.87\, g_Y} - \underset{(1.13)}{.004\, g_i} - \underset{(.16)}{.035\, WINF} - .66 \frac{D_1}{M1}\, g_{D_1}$$

$R^2 = .63$

Durbin-Watson statistic = 1.88

The separate hypotheses of the income variable's being + 1.0, the domestic credit variable's being - 1.0, and the price variable's being + 1.0 all have to be accepted at the .05 level of significance. The interest rate variable is negative, but not significantly different from zero at the .05 level. A comparison of equations (1.21) and (1.28) shows that they are similar. The price variable changed sign from a low positive value to a negative, but the standard error was in both cases so large that the null hypothesis could not be rejected. The income coefficient was closer to its expected value in equation (1.28) and the domestic credit variable obtained approximately the same coefficient. In terms of explanatory power, as measured by $R^2$,

the equations are about equal with equation (1.21) yielding a slightly higher value. Based on these results, as well as the evidence from the direct test of the integrated market hypothesis, it seems like the world price inflation is a good measure for the domestic price inflation.

Single Equation Estimates, Explicitly Introducing World Relations

The basic reserve flow equation (1.21) is extended to explicitly take into consideration world monetary equilibrium. This extension of the model builds on the model developed by Cox and Wilford (8, 1976). The reserve flow equation is defined as:

$$(1.29)\quad \frac{R(z)}{M1(z)}\, g_{R(z)} = a_2 g_{Y(z)} - b_2 g_{Y(f)} + a_4 \frac{D_1(f)}{M1(f)}\, g_{D_1(f)} + a_5 \frac{D_1(z)}{M1(z)}\, g_{D_1(z)} + a_6 g_{i(z)}$$

where:

$g_{Y(f)}$ = permanent income growth in the rest of the world.

This variable is defined as the weighted average of the permanent income growth in 10 countries where the countries and the weights are the same as those in equation (1.9). Foreign credit creation, $D_1(f)$, is defined alternatively as the weighted and unweighted average of Norway's nine major trade partners. The weights being the respective countries' share of trade with Norway. Estimation of equation (1.29) for the period 1955 to 1970 yielded the following results:

$$(1.30)\quad \frac{R(z)}{M1(z)}\, g_{R(z)} = \underset{(.10)}{-.03}\, g_i + \underset{(.80)}{1.24}\, g_{Y(z)} - \underset{(.78)}{.39}\, g_{Y(f)} \underset{(.40)}{-.11} \frac{D_1(f)}{M1(f)}\, g_{D_1(f)} - \underset{(.18)}{.70} \frac{D_1(z)}{M1(z)}\, g_{D_1(z)}$$

$R^2 = .64$

Durbin-Watson statistic = 2.15

The monetary model predicts a value of - 1.0 for the foreign income variable and a value of + 1.0 for the foreign credit variable. Testing these hypotheses, we find that we cannot reject the hypothesis that the foreign income variable is - 1.0, but we have to rejcet the hypothesis that the foreign credit variable is + 1.0. The domestic credit variable enters with a coefficient of - .70 and a standard error of .18. Thus, we cannot reject the hypothesis that this coefficient is - 1.0. All these tests were conducted at the .05 significance level.

Since the following relationship holds:

$$(1.31) \quad g_{p(z)} = - b_2 g_{Y(f)} + \frac{D_1(f)}{M1(f)} g_{D_1(f)} - g_{i(z)},$$

we can compare the estimates in equation (1.29) with those obtained in equation (1.21). In terms of explanatory power, the equations yield about the same value. The coefficients obtained for the domestic income and domestic credit variables are approximately equal. These findings indicate that the growth in foreign income and the growth in foreign credit are good measures of the exogenously determined domestic price variable. Estimation of equation (1.29), restricting the coefficients of home and foreign income growth to the same absolute value, yielded estimates of the coefficient similar to those obtained in equation (1.30). The model was also reestimated using the unweighted measure of foreign credit creation and the resulting estimates were very much in line with those obtained using the weighted average measure of foreign credit.

Single Equation Estimates with Attention to the 1967 Devaluations

In 1967, several of Norway's major trade partners devalued their

currencies, these countries, Denmark, Finland, Iceland, Ireland and the United Kingdom, collectively accounted for 22% of Norway's imports and 29% of Norway's exports in 1967. It is of interest to see if these devaluations had any effect on the development of the Norwegian reserve flows. To test for this effect, several models of the reserve flow equation incorporating time dummy variables were estimated. The effect of the devaluations by the other countries should be an outflow of reserves. Thus, a negative sign is expected for the coefficient of the time dummy variable for the period in which the devaluation effect is felt. If we assume an instantaneous adjustment process, we would expect the effect of the devaluations to show up already in the year 1967-1968. In the first model, this assumption is made and the following model is estimated:

$$(1.32)\quad \frac{R}{M1}\, g_R = a_1 g_Y + a_2 g_i + a_3 g_p + a_4 T + a_5 \frac{D_1}{M1}\, g_{D_1} + u$$

where:

T = 1 if year is 1967-68

T = 0 if year is not 1967-68

The estimation of this model yielded the following estimates:

$$(1.33)\quad \frac{R}{M1}\, g_R = .55\, g_Y - .03\, g_i + .30\, g_p + .06\, T - .70\, \frac{D_1}{M1}\, g_{D_1}$$

$$\qquad\qquad\quad (.23) \quad (.07) \quad (.40) \quad (.03) \quad (.14)$$

$R^2 = .75$

Durbin-Watson statistic = 1.66

The coefficients for the regular reserve flow equation variables are all very close to the results obtained in equation (1.21), and the separate hypotheses of the income, price and domestic credit variables having their expected values cannot be rejected at the .05 level of significance.

The time dummy variable coefficient is positive and not significantly different from zero at the .05 level. This result does not support the expectation that the devaluation effect can be noted immediately, but other trade conditions changed considerably at the same time. The time dummy variable, therefore, may be picking up these effects as well as the devaluations effects. Next, assume that the effect of the devaluations on Norway was not felt immediately, but showed up in the year 1968 to 1969. To test this, a new model was estimated with a time dummy variable for this year. The estimation results were similar to those obtained in equation (1.33), but the time dummy variable was now negative as expected. The coefficient of this variable was, however, a low .02 and it had a standard error of .04; thus, it is not significantly different from zero at the .05 level of significance. This model supports to some extent the hypothesis of a devaluation effect in 1968-69, but the support is rather weak as the coefficient is not significantly different from zero.

Another way to get an indication of the effect of these devaluations is to examine the effect on these countries' shares of Norway's exports and imports. But we have to be careful because of the presence of other influences that simultaneously affect these shares. An examination of the shares of exports and imports show that the shares of exports increased up to 1967, but dropped in 1968. The pattern for the import shares was not that clear, but, in general, there was a continuing increase in the shares. From this, as well as from the regression results, it seems that Norway was affected to some extent by the devaluations of its major trade partners in 1967.

Simultaneous Equation Model

The single equation models treated so far all assume that the line of causation is from domestic credit to reserves, but arguments have been made that governments act in order to maintain a stable money supply. Such a goal implies that domestic credit would be a function of reserves. Studies to test this hypothesis have been conducted by Connolly and Taylor (5, 1975) and Genberg (14, 1976). Connolly and Taylor found evidence of sterilization behavior for developed countries but not for developing countries. Genberg concluded that the sterilization hypothesis was not likely to hold for the case of Sweden. To test the sterilization hypothesis for the case of Norway, the following simultaneous equation model was constructed:

$$(1.34) \quad \frac{R}{M1} g_R = a_1 g_i + a_2 g_p + a_3 g_Y + a_4 \frac{D_1}{M1} g_{D_1} + u$$

$$(1.35) \quad \frac{D_1}{M1} g_{D_1} = b_1 \frac{R}{M1} g_R + u'$$

where all the variables are as defined earlier.

Since this system is underidentified, it cannot give estimates of all the parameters. We can, however, estimate equation (1.35) consistently by two-stage least squares since this equation by itself is identified. Estimation of this equation by a two-stage lease squares procedure for the period 1955 to 1970 yielded the following estimates:

$$(1.36) \quad \frac{D_1}{M1} g_{D_1} = .83 \frac{R}{M1} g_R$$

We note that the coefficient for the reserve variable is positive with a value of .83 as opposed to its expected - 1.0, if the sterilization hypothesis holds. The standard error is a high .66, which implies that

the coefficient is not significantly different from zero at the .05 level. This estimation indicates that the sterilization hypothesis can be rejected for the case of Norway for the period 1955 to 1970.

To get more information about the possibility of a neutralization policy being conducted during this period, we can look at the actual policy actions taken and the goals expressed for monetary policy. Norway's holding of foreign reserves increased during most of these years. The only years which experienced a decline were 1961, 1962 and 1969.[7] In spite of this steady increase in foreign reserves, there were expressions of fear of a reserve outflow.[8] This attitude was particularly predominant up to 1965, when the attitude was changed to some degree as a result of the higher level of accumulated reserves.[9] In 1955 the authorities implemented a restrictive monetary policy aimed at a reduction in investment demand and through this reduction an improvement in the foreign sector of the economy.[10] The fear of a reserve loss was the underlying reason for the concern with the record high deficit on the trade balance. If the authorities had followed a neutralization policy, they would have planned on increasing the domestic credit in order to offset the expected loss in reserves. The next example of this monetary policy will be taken from the years 1961 and 1962 when international reserves actually started to flow out of the country. The goal for the credit policy during those years is stated in Økonomisk Utsyn over Aaret 1962, p. 107:

> The government's purpose for limiting the supply of credit to the market has been to dampen the investment activity. The reasoning behind this is the wish to reduce the demand for goods and services in order to decrease the pressure on prices, wages and the foreign trade economy.

To reach this goal, credit policy was tightened, restrictions were re-introduced on bank advances and it was agreed that bank advances should be reduced to a certain fixed amount before November that year.[11] This attempt in 1961, to restrict domestic credit failed, mainly due to the bank's possibilities of expansion in the foreign credit market.[12] As a consequence, foreign reserves started to flow out of the country In reaction to this, new steps were taken in order to gain better control over loans in foreign currency from commercial banks and new limits were set for loans from commercial and savings banks. In addition to these monetary restrictions, the volume of building activity licensed for 1962 was kept at the same level as that in the prior year. The effect of these measures was a substantial decrease in the growth rate of domestic credit and foreign reserves started to increase.[13]

From 1965 on, a somewhat different attitude seems to be present. The concern over a reserve outflow is now expressed as of secondary importance. This change can be seen in statements in Økonomisk Utsyn over Aaret, 1967, p. 142 and Økonomisk Utsyn over Aaret 1965, p. 138. The latter reads:

> But with the build up of foreign exchange reserves that has taken place, Norway should have adequate freedom of maneuverability, if it is faced with a choice between regard for the internal level of activity and regard for the external balance.

The sterilization policy allowed for here was never actually utilized in the period 1965 to 1970. The aim of the monetary policy was in all the years, with a slight exception of 1968,[14] to restrict the credit financed demand. The institutional evidence thus suggests that Norway did indeed follow the reverse policy of that indicated by the sterilization hypothesis.

## Conclusions

The empirical testing of the integrated market hypothesis indicated that the hypothesis holds for the case of Norway. Thus, we are justified in using this assumption in the monetary model. The monetary model of the balance of payments receives some support, but this support is not too strong. For domestic credit variable, the hypothesis of its being - 1.0 cannot be rejected at the .05 level of significance in most cases. The income variable is also within two standard deviations of its expected value of + 1.0 in most of the models. The price variable is usually far from its expected value of + 1.0, but it enters with such large standard errors that nonrejection of the null hypothesis is the common conclusion. The joint hypothesis of the income, price and domestic credit variables simultaneously obtaining their expected values had to be rejected at the .05 level of significance. The Chow test for stability of the parameters gave the conclusion that one model could be fitted for the whole period. The model incorporating world relations showed that foreign credit creation and foreign income are good measures of the internal price and interest rate variables. The simultaneous equation model did not yield any support for the sterilization hypothesis.

## Notes

[1]Calculated on basis of data from International Financial Statistic (17).

[2]A. Dammann (9, 1973, p. 368).

[3]International Financial Statistics (17).

[4]Calculated on basis of data from International Financial Statistics (17).

[5]G. S. Maddala (20, 1977, p. 198).

[6]G. S. Maddala (20, 1977, p. 198).

[7]International Financial Statistics (17).

[8]A. Dammann (9, 1973, p. 333).

[9]Økonomisk Utsyn over Aaret, 1965 (38, 1965, p. 138).

[10]Økonomisk Utsyn over Aaret, 1955 (28, 1955, p. 137).

[11]A. Dammann (9, 1973, p. 353).

[12]A. Dammann (9, 1973, p. 353).

[13]A. Dammann (9, 1973, p. 354).

[14]Økonomisk Utsyn over Aaret 1968 (41, 1968, p. 135).

## CHAPTER II

## GENERAL MACROECONOMIC DEVELOPMENT IN NORWAY DURING THE PERIOD 1955-1970

Until the early 1950's, Norway's economy was greatly influenced by the after effects of the Second World War, but by 1955 most of these effects had worn off. Norway's real gross national product increased fairly steadily during the period 1955-1970, with an average annual growth rate of 7.8%.[1] The year 1957-58 represents an exception to this development as Norway was greatly influenced by the world wide recession and the rate of growth fell to a negative - 0.45. In contrast, 1963-1964 were years of exceptionally high growth in the gross national product. The upturn in the growth rate that occurred in 1958-1959 can be linked mainly to the greatly increased demand from abroad for Norwegian goods and services and to the increased domestic building activity.[2] The rate of growth in the latter part of the sixties was somewhat lower, but Norway was not much affected by the reduced growth rates in many of the other European countries in 1966 and 1967.[3] There was more of a setback in 1968, but this trend had almost completely worn off by 1970.[4]

The rate of investment had been high during most of the period. This was not ture in 1956, when the government's policy of curtailing investments succeeded. These investment restrictions, however, were eased the following year and the rate of growth in gross investments

increased again.[5] Investments expanded rapidly in 1959, 1960 and in the first half of 1961,[6] this development was mainly a result of the credit agreements between the authorities and the private banking system, as the agreements for these years did not, as in previous years, set limits for loans from commercial and savings banks.[7] The increase in investment demand was less in 1963 and 1964, but private investment started improving after the 1962-1963 weakness.[8] Gross fixed capital formation increased more from 1966 to 1967 than in any other year in this period, but this tendency did not continue into 1968, when, if fact, there was a decrease in gross fixed capital formation.[9] This decrease continued in 1969, but it increased again in 1970.[10] The high level of investment to a large extent has been financed through foreign borrowing, and a large part of this borrowing has been mortgage loans for ships.[11]

Norway's balance on the current account during most of the 1955-1970 period has been negative, but total borrowing aborad has more than exceeded this deficit in all but three of the years. Consequently, there has been a fairly steady increase in foreign reserves.[12] The deficit on the current account has not greatly concerned the Norwegian authorities. Their concern has rather been with the utilization of the imports and it has been regarded as favorable if used for profitable investment. The Bank of Norway, however, has assumed the task of cautioning against excessive deficits in fear that they might lead to reserve outflows.[13] The balance on the current account has been influenced greatly by development in the shipping sector, i.e., by the freight earnings and by the import and export of ships. The size and development of this sector can be illustrated by the fact that the

merchant fleet has been built up from a 5.1 million gross register tonnage in 1951 to 22 million in 1971.[14]

Prices have been steadily increasing: the average annual inflation rate, using the consumer price index, was 3.4% in the period 1955 to 1970.[15] There existed significant year to year variation in the rate of growth with the year 1969 to 1970 to a large extent explained by the value added tax that was introduced at that time.[16] The development of the import price index, the export price index and the combined home and import price index is interesting especially when they are compared to each other. All three indices moved upward at about the same rate of growth until 1957 when they all decreased. From 1958 until 1963, the home and import price index increased moderately while the other two decreased slightly. From 1963 to 1968 whe the home and import price increased sharply while the other two showed moderate increases and decreases. From 1968 to 1970 all three have been moving upwards.[17]

Trade restrictions and regulations have been decreased considerably during this time period.[18] Of vital importance in this connection is Norway's membership in the European Free Trade Association. The European Free Trade Association was established in 1959 and by January 1, 1967, virtually all protective tariffs on trade in industrial goods had been abolished.[19] The negotiations within the "General Agreement on Tariffs and Trade", GATT, have also been of great importance for the development of Norway's trade during this period.[20]

Considered as a whole, the period 1955 to 1970 has been one of rapid economic development for Norway. Its holdings of foreign reserves have been steadily increasing, at the same time most of the years were

characterized by a high demand pressure and a fairly high internal price pressure. The change in political power in 1965 from a socialistic majority in the National Assembly to a non-socialistic majority did not change the direction of economic policy to any great extent. The new government continued the high level of government involvement in the economy and they also maintained the low interest rate policy of the socialistic party.[21]

Monetary Policy in Norway: 1955-1970

The following will concentrate on the monetary policy tools and methods used by the Norwegian authorities during the period 1955-1970. Moreover, as far as possible, it will analyze the reasons behind the actions. This period naturally lends itself to subdivision into two subperiods as far as monetary policy is concerned. The reason for this division is the Act on Monetary Control that was passed in 1965. This Act brought with it a change in the methods used for conducting monetary policy. The two periods will thus be from 1955 to 1965 and from 1965 to 1970.

Monetary Policy: 1955-1965

Monetary policy during this period was dominated by the Credit Agreements reached in the Joint Consultation Council. The Joint Consultation Council, formed in 1951, was a committee consisting of representatives from the Bank of Norway, the Ministry of Finance, the commercial and savings banks and later on the insurance companies.[22] All major monetary policy moves during this period were negotiated in this Council.

In 1955, the balance of payments suffered a large deficit, there was high demand, and an upward pressure on interest rates.[23] To reduce these problems the discount rate was increased by 1% to 3.5%, lending quotas for state banks were decreased. a government loan was issued, the volume of capital issues decreased, savings were encouraged and investment discouraged, statutory reserve requirements for banks introduced and stricter guidelines for banks were agreed upon in the Joint Consultation Council.[24] The authorities feared in this situation that a further development along the same lines would eventually lead to an outflow of foreign reserves. No reserve outflow actually happened, but the actions induced by the threat indicates that the authorities would not act so as to sterilize the effect of a reserve outflow, but rather take the opposite action. This point will be discussed further in connection with the treatment of a simultaneous equation model for reserve flows. The initial restrictive measures did not bring forth the aimed for reduction in domestic credit, thus further measures had to be taken and a program of additional restrictions were agreed upon by the Joint Consultation Council. The main results of this agreement were to keep loans at the same level in 1956 and 1957 as they were in 1955, These additional restrictions effectively reduced liquidity, but in addition they treated commercial and savings banks differently, allowing for more expansion by the savings banks.

In 1957 and 1958 the Norwegian economy was influenced by the world recession, this downturn made the authorities relax some of the credit restrictions that were introduced in 1955, and by 1958 the Norwegian economy picked up again.[25]

Stricter monetary policy was again found to be necessary in 1961.[26] The reason was once again increased demand pressure coupled with concern over the balance of payments deficit. In fact, 1962 was the only year in this period when foreign reserves actually declined. As we shall see, the restrictive measures introduced were not strong enough to decrease domestic credit creation sufficiently, due primarily to the banks' opportunities of obtaining funds in the foreign market.[27] In 1962 the banks' possibilities of operating in the foreign market were brought under control and the credit restriction proved successful in controlling the domestic credit and the foreign reserves started increasing.[28]

The monetary policy in the years 1960 to 1965 was based on a "Framework Agreement"[29] reached by the Joint Consultation Council. This agreement was of a general format and it introduced regulation for purchases of government bonds by banks and insurance companies, linked the interest rate on Government bonds to the interest rates on mortgage loans and other bond issues, abolished reserve requirements for savings banks, provided the opportunity for expansion of the reserve requirements, and stipulated that guidelines for lending activities would be established for each year. The years 1964 and 1965 were both characterized by high demand[30] and a deficit on the current account of the balance of payments,[31] in spite of this the government and the Bank of Norway increased the liquidity at the same time that they tried to reduce the liquidity in the private sector.[32]

In 1963, a report on monetary policy suggested wide discretionary power to the government. The financial institutions opposed the proposal and informed the authorities that they would leave the

Joint Consultation Council if this proposal were passed as a law.[34] The Act was passed in 1965 and when the financial institutions left the Joint Consultation Council it was dissolved.

Monetary Policy: 1965-1970

The Act for Monetary Policy was passed in June 1965, and became effective in January 1966. This Act[35] enabled the Government to introduce: (a) liquidity reserve requirements for banks based on total liabilities or on an increase in lending or on an increase in loans and foreigners' deposits in foreign exchange; (b) compulsory purchase or holdings of bonds for banks and insurance companies; (c) a ceiling on lending for "nonbank" lending institutions; (d) a duty to report to the Bank of Norway on their activities and interest rates, for all financial institutions; (e) power to the government to set maximum interest rates; and (f) the same power as earlier to regulate capital issues. The chosen policy instruments were first and foremost the setting of the reserve requirements and the regulation of interest rates through maximum interest rate ceilings. The reserve requirements were made up of two parts primary and secondary liquid assets, and the requirements varied with the type and size of the bank.[36]

During 1966, bank advances increased more than desired thus the reserve requirements were increased and a supplementary reserve requirement was introduced. This slowed down the expansion, and faced with this policy the commercial banks entered into an agreement with the authorities and a level for advances were set for the following year.[37] An agreement was also reached with the insurance companies, but not with the savings banks. These years were all years of high growth in the Norwegian economy, with high demand pressure.[38] In spite of the agreements reached in 1967, the domestic credit increased too

rapidly, and the reserve requirements were increased in the middle of of the year.[39] But in 1965, 1966 and 1967 the banks and the public compensated for the liquidity reducing actions by sale of foreign currency to the Bank of Norway. In 1968 and 1969 formal agreements were made with insurance companies only. Bank lending was controlled through the annual announcement of the government's target for bank loans. This had the potential for being effective because of the underlying threat of an increase in the reserve requirements if the target were not adopted by the banks. This policy appeared sufficient to control the domestic credit in 1968, but was probably due to the decreased economic pressure in that year.[40] But in 1969 when the economic pressure increased, the reserve ratios for the commercial banks were increased.[41] The discount rate was increased by 1% to 4.5% in 1969. This increase almost immediately affected the different interest rates by an increase of ½ to 1%.

In the Fall of 1969 several other monetary restrictions were introduced, due partly to the government's plan of increased government activity in 1970. The more important decisions were:[42] (a) compulsory purchase of Norwegian bearer bonds by banks, insurance companies and pension funds based on the growth in their total resources; and (b) regulation of the interest rates although adjustments were allowed following the discount rate increase. Once again high demand pressure was experienced in 1970 and the reserve requirements were increased several times.

Short Explanation of the Norwegian Bank System's Institutions

The Norwegian bank system with approximate command chains has been drawn in Figure 1, Appendix I. Here each of the different institutions will be briefly explained as to their organizational structure and working areas.

1. The Norwegian Government

The responsibility for the monetary policy rests with the government.[44] The government has the law giving power.

2. The Department of Finance

The Department of Finance and the Bank of Norway do the planning and implementing the monetary policy. The Department of Finance is responsible for developing quantitative goals for the supply of domestic credit from the various credit sources.[45]

3. The Deparment of Commerce

Foreign trade is strictly regualted, and the regulation of foreign payments is considered an important part of Norway's monetary policy. The responsibility for the foreign payment regulation enforcement is shared by the Department of Commerce and the Bank of Norway.[46]

4. The Bank of Norway

The Bank of Norway is a government bank, organized as a joint stock company, where the Norwegian state is the only shareholder.[47] Further discussion of the development of the Bank of Norway can be found in Appendix I. The Bank of Norway is the currency issuing agency. The bank works in close cooperation with the Norwegian government, the Department of Finance and the Department of Commerce. In connection with the attempt to control the domestic credit supply, the Bank of Norway receives a set of quantitative goals from the Department of Finance and develops suggestions for regulations or other actions necessary to reach these goals. Based on this advice, the Government makes the

final decision on what action to follow.[48] The enforcement of these decisions is then delegated to the Bank of Norway. The Bank of Norway is involved with the enforcement of the foreign trade regulations in cooperation with the Department of Commerce, the responsibility is divided on the basis of the type of foreign payment transaction that is involved.[49]

The domestic bond market is also subject to direct regulation, the total volume, the conditions and the distribution among issuers are all determined by government agencies in this case the Department of Finance and the Bank of Norway.[50]

The Bank of Norway also has some policy instruments which they can use independently.[51] These instruments include the discount rate, rules for loan issuing to other banks and open market operations. But close cooperation between the government agencies makes it of smaller importance who has the formal decision power.

5. Government Banks

Government banks are to some extent a typical Norwegian development, as indicated in the name these banks are all government operated and financed. The reasons for the development and expansion of the system of government banks are several, the main one, however, was a desire to guarantee credit to special sectors of the economy that would have problems obtaining credit in the existing credit market. In 1970 eight government banks were in operation and they accounted for 2.08% of the loan market.[52]

6. Commercial Banks

The commercial banks are organized as joint stock companies with at least twenty shareholders. When they reach a certain size, they are subject to more direct control through government representation in the Board. The commercial banks account for 26.44% of the loan market. The commercial banks are both borrowing and lending institutions, they have a slight preference for issuing short term loans as compared to long term loans.[53]

7. Savings Banks

Savings banks are "not for profit" institutions in the sense that no one is entitled to any dividend and the banks develop into self-owned institutions over time. The local government is to elect at least one-fourth of the Board members. The savings banks are generally small banks, they offer approximately the same services as the commercial banks, but they tend to concentrate their lending on long term loans.[54]

6&7. Commercial and Savings Banks

An important factor both for commercial and savings banks is that the larger ones are authorized to keep foreign exchange deposits in banks abroad and also to receive deposits of this kind from their customers. Subject to licensing these banks may also borrow abroad on their own account. This borrowing is then a source of additional finance for the banks' domestic lending.[55]

8. Loan Associations

Loan associations issue credit of medium to long term duration to housebuilding, shipbuilding, etc. They obtain their

funds from issuing bearer bonds and because of this the government can control the extent of their operation. Loan associations accounted for 9.46% of the loan market in 1970.[56]

9. Insurance Companies

Insurance companies usually get their funds from insurance premiums. The accounted for 10.6% of the loan market in 1970, a share that has been steadily increasing since 1950 when it was 7.5%.[57]

## Notes

[1]The average annual growth rate is calculated on basis of data reported in International Financial Statistics. (17).

[2]Økonomisk Utsyn over Aaret 1957 (30, 1957, p. 133).

[3]Økonomisk Utsyn over Aaret 1967 (40, 1967, p. 136).

[4]Økonomisk Utsyn over Aaret 1968 (41, 1968, p. 135). "Last year's production figures may seem to constitute a break in the expansive trend. The impetus behind the rapid expansion up to 1967 largely derived both from exports and from investments in fixed real capital, was particularly powerful in 1967. What was new about 1968 was that investments in fixed capital no longer provided growth incentives of significance to expansion of production. Growth incentives in 1968 stemmed almost exclusively from the demand from abroad."

[5]Økonomisk Utsyn over Aaret 1956 (29, 1956, p. 129). Økonomisk Utsyn over Aaret, (30, 1957, p. 133). "Norway was among the few countries which eased restrictions on investments in 1957."

[6]Økonomisk Utsyn over Aaret 1960 (33, 1960, p. 120).

[7]Økonomisk Utsyn over Aaret 1960 (33, 1960, p. 120). "A considerable easing of monetary policy accompanied the relaxation in fiscal policy. The 1959 and 1960 credit agreements with the private credit institutions did not, as in the four previous years impose a limit on the lending activities of the private banks."

[8]Økonomisk Utsyn over Aaret 1964 (37, 1964, p. 138).

[9]Økonomisk Utsyn over Aaret 1967 (40, 1967, p. 138); Økonomisk Utsyn over Aaret 1969, (42, 1969, p. 135).

[10]Økonomisk Utsyn over Aaret 1970 (43, 1970, p. 153).

[11]A. Dammann (9, 1973, p. 369). "The largest part of this borrowing has involved mortgage loans for ships. The prerequisite for getting a license for the building of tankers in foreign shipyards, however, has been that the financing should be arranged abroad. Thus, out of the total of Norwegian capital import from 1946 to 1965, i.e., N. Kr. 7.8 billion was net borrowing for ships."

[12]A. Dammann (9, 1973, p. 369).

[13]A. Dammann (9, 1973, p. 333): "Pursuing the Bank's Annual reports from 1955 on, one finds that the balance of trade has most frequently been described as the one factor which must not be overlooked in policy decisions. Norway has so far been able to finance its import surplus and, at the same time, to increase its foreign reserves. But the Bank has never taken this for granted. It has warned against an expansion which might lead to a decline in the reserves. One might perhaps conclude that expansionary forces, with inflation on their tail, have been tolerated as long as they have not pushed up internal costs of production in such a degree as to reduce the competitiveness of the country's industries and to create a risk of a fall in foreign exchange reserves."

[14]A. Dammann (9, 1973, p. 369).

[15]Calculated on the basis of data for the consumer price index reported in International Financial Statistics (17).

[16]A. Dammann (9, 1973, p. 369): "The value added tax introduced in 1969-70 caused a 5.8 percent jump upwards in the price level. In addition to this, there was in 1970 and 1971 an annual average price increase of 6 percent."

[17]Observations are based on data for the home and import price index, the import price index and the export price index reported in International Financial Statistics. (17)

[18]Norges Bank gjennom 150 Aar (11, 1966, pp. 378-388).

[19]Økonomisk Utsyn over Aaret, 1967 (28, 1967, p. 142).

[20]S. D. Cohen, The European Community and the General Agreement on Tariffs and Trade (4, 1975).

[21]A. Dammann (9, 1973, p. 337): "To the surprise of many people the non-soicalistic coalition government (1965-1971) continued and even intensified the accumulation of state capital and expanded the public sector's share of the gross domestic product considerably."

[22]A. Dammann (9, 1973, p. 348): "In this situation the Joint Consultation Council came into being. It was appointed in January 1951 by the Minister of Finance, after a proposal by the Governor of the Bank of Norway. At the beginning only representatives of commercial and savings banks were on the Council, together with representatives of the Bank of Norway (in the chair) and the government. Later also insurance companies were represented."

[23]A. Dammann (9, 1973, pp. 349-350).

[24]A. Damman (9, 1973, p. 350), Part of the press release by the Bank of Norway is reproduced in Appendix III.

[25]Økonomisk Utsyn over Aaret 1964 (36, 1964, p. 112).

[26]Økonomisk Utsyn over Aaret 1962 (35, 1962, pp. 133, 118); A. Dammann p. 353.

[27]Økonomisk Utsyn over Aaret 1962 (35, 1962, p. 118); Økonomisk Utsyn over Aaret 1963, (36, 1963, p. 108).

[28]Økonomisk Utsyn over Aaret 1963 (36, 1963, p. 108); A. Dammann, p. 350.

[29]Bank of Norway, Report and Accounts 1960. Quoted in A. Dammann, pp. 352-353, and reproduced in Appendix III.

[30]Økonomisk Utsyn over Aaret 1964 (37, 1964, pp. 136, 137); Økonomisk Utsyn over Aaret 1965 (38, 1965, p. 133).

[31]Økonomisk Utsyn over Aaret 1964 (37, 1964, p. 139); Økonomisk Utsyn over Aaret 1965 (38, 1965, p. 137).

[32]Økonomisk Utsyn over Aaret 1965 (38, 1965, p. 133).

[33]A. Dammann (9, 1973, p. 355).

[34]A. Dammann (9, 1973, p. 355).

[35]E. M. Syring Jr., Appendix B, reproduced in Appendix III (23, 1968).

[36]A. Dammann (9, 1973, p. 356).

[37]A. Dammann (9, 1973, p. 359).

[38]Økonomisk Utsyn over Aaret 1967 (40, 1967, p. 138).

[39]A. Dammann (9, 1973, p. 359).

[40]A. Dammann (9, 1973, p. 359).

[41]A. Dammann (9, 1973, p. 359).

[42]A. Dammann (9, 1973, p. 360).

[43]Økonomisk Utsyn over Aaret 1970 (43, 1970, p. 12).

[44]L. Eide (10, 1973, p. 7). The Law Concerning the Authority to Regulate Monetary and Credit Conditions. Chapter 1, part 1 and 2; Appendix III.

[45]L. Eide (10, 1973, p. 7).The Law Concerning the Authroity to Regulate Monetary and Credit Conditions, part 2.

[46]L. Eide (10, 1973, p. 7). The Law Concerning the Authority to Regulate Monetary and Credit Conditions, part 2.

[47]L. Eide (10, 1973, p. 8).

[48]L. Eide (10, 1973, p. 7).

[49]L. Eide (10, 1973, p. 7).

[50]L. Eide (10, 1973, pp.17, 18).

[51]L. Eide (10, 1973, p. 7).

[52]E. M. Syring, Jr. (23, 1966, pp. 90, 91).

[53]E. M. Syring, Jr. (23, 1966, pp. 93-99); A. Dammann, (9, 1973, pp. 335, 336).

[54]L. Eide (10, 1973, pp. 9. 15).

[55]A. Dammann (9, 1973, p. 336).

[56]E. M. Syring, Jr. (23, 1966, pp. 104, 106).

[57]E. M. Syring, Jr. (23, 1966, pp. 107-111).

CHAPTER III

# BALANCE OF PAYMENTS APPROACHES, HISTORY, THEORY AND A LITERATURE REVIEW OF THE MONETARY APPROACH

## Brief History of the Development of the Balance of Payments Theory

The history of the development of the balance of payments theory has been dealt with fairly extensively in the existing literature. Special reference in this respect can be made to the work of J. A. Frenkel and H. G. Johnson in their article, "The Monetary Approach to the Balance of Payments: Essential Concepts and Historical Origins" and to the article, "Towards a General Theory of the Balance of Payments" by H. G. Johnson (18, 1976) (19, 1976).

The ideas in the monetary approach to the balance of payments can be traced back to the thoughts of the classical and neoclassical schools. The integrated market hypothesis, which is an essential part of this theory, was dealt with by several writers, among others Mill, Cassel and Ricardo. The thought of a natural distribution of money among countries dates back to the same people. The monetary approach came in disrepute in the 1930's, this was partly due to the economic conditions of that time since the assumptions of the monetary model of monetary equilibrium and full employment were not fulfilled.

The monetary approach started to receive renewed attention in the early 1950's, one of the earliest works was the development by

J. Meade in his The Balance of Payments (21, 1951). This work was further developed by H. G. Johnson and R. A. Mundell together with other writers. Johnson generalized the theory of the balance of payments, while Mundell worked with the theory of the policy mix. In recent years, several empirical studies of the monetary approach to the balance of payments have been conducted. These will be treated in a later part of this chapter.

## A Short Review of the Three Different Approaches to the Balance of Payments Analysis

The three approaches, the elasticity approach, the absorption approach, and the monetary approach are in theory identical in the sense that in a giant full-information simultaneous equation model, they would yield identical answers. The differences are that they base the analysis on different sectors and make different assumptions. Thus, for empirical studies each approach leads to the use of different variables.

### The Elasticity Approach

Models building on the elasticity approach to the balance of payments have been used by several people, a derivation of the model can be found among other places in R. H. Heller, International Monetary Economics, (16, 1974). This approach views the problem from the goods sector. It defines the balance of payments as the difference between the value of exports and the value of imports. By manipulating this relationship it is found that the conditions for a worsening or improvement in the balance of payments is dependent upon the signs of the home and foreign import and export elasticities. As

a consequence, the attention is focused on terms of trade and relative prices of import and export goods. In its simplest form the elasticity approach assumes that all goods are traded, but the model has been extended to incorporate nontraded goods.

The Absorption Approach

This approach is outlined in S. Alexander's "The Effects of Devaluation: A Simplified Synthesis of Elasticities and Absorption Approaches" (1, 1959). This approach bases the analysis on the identity of the balance of trade with the difference between the total value of domestic output and the total value of domestic absorption, where absorption is defined as consumption plus investment. The effects on production and absorption are the variables of interest in this approach and a distinction is made between the direct and indirect effects. Important effects to be studied are the idle resoruce effect, the terms of trade effect, the cash balance effect and the income redistribution effect. For purpose of empirically testing this approach, H. Genberg (13, 1974) defined the change in the balance of payments as a function of unemployed resources before devaluation, progressivity of the tax structure, and the size of the devaluation.

The Monetary Approach

The monetary approach to the balance of payments concentrates on the monetary sector of the economy. The basic monetary model is outlined in Johnson's article, "The Monetary Approach to Balance of Payments Theory" (18, 1976). Most other work in this area builds on this model, that is especially true of the empirical studies. The monetary model builds on the assumptions:

1. The adjustment mechanism is instantaneous such that money demand equals money supply.

2. The purchasing power parity holds.

3. The interest rate parity holds.

4. The economy is in a state of full employment.

The simple monetary model, due to Johnson consists of the following relationships:

(3.1) $M_d = p\, f(Y,i)$

where:

$M_d$ = the demand for money

$p$ = the price level, no subscript necessary since home and foreign price levels are assumed equal, assumption 2.

$Y$ = income

$i$ = interest rate

For simplicity it is assumed that the demand for money is homogeneous of degree one in prices.

(3.2) $M_s = R + D$

where:

$M_s$ = the supply of money

$R$ = international reserves

$D$ = domestic credit

From assumption 1 we can equate money supply and demand:

(3.3) $M_s = M_d$.

This can be rewritten, using the relationships in (3.1) and (3.2) as:

(3.4) $R = M_d - D$.

If we substitute from equation (3.1) the expression for $M_d$, rewrite in terms of logs and totally differentiate, we will get the following relationship expressed in growth terms:

$$(3.5) \qquad g_R = \frac{1}{r}\left(g_p + n_Y g_Y + n_i g_i\right) - \frac{1-r}{r} g_D$$

where:

$g_p$ = the rate of growth in price

$g_Y$ = the rate of growth in income

$g_i$ = the rate of growth in the interest rate

$g_D$ = the rate of growth in domestic credit

$$r = \frac{R}{M_s} = \frac{R}{M_d}$$

$n_Y$ = the income elasticity

$n_i$ = the interest rate elasticity

This is the basic reserve flow equation of the monetary model. The model predicts an inverse relationship between the reserve flow and the domestic credit creation, this relationship is central to the approach. This basic model has been modified in several ways, it has been changed so as to relax the small country assumption, and the assumption of purchasing power parity has been replaced by a lagged adjustment mechanism. Work with the above extensions of the model has been conducted by Johnson (18, 1976) and Genberg (14, 1976). The model has also been extended to take into consideration the possibility of simultaneity between the reserve flow and domestic credit. Work in this area has been done by Genberg (14, 1976) and by Connolly and Taylor (5, 1975).

Review of Some Empirical Studies of the Monetary Approach to the Balance of Payments

Some of the empirical work has already been mentioned, but here I will deal with some additional studies and will provide more detail. All the empirical studies discussed are based on the basic monetary model outlined by Johnson (18), making some changes in assumptions and definitions.

R. J. Zecher (27, 1976) studied the case of Australia during the period 1950 to 1971. His model uses a specific form of the money demand function which is defined as:

$$(3.6) \qquad (\frac{M}{P})^d = \frac{Y^{a_1} e}{i^{a_2}}$$

where:

$(\frac{M}{P})^d$ = demand for real money

Y = permanent income

e = stochastic error term

i = interest rate

The reason given for this specification is the fact that the Australian interest rate is considered exogenously determined, and thus reflects movements in the world interest rate. The measure used for the interest rate variable is a two-year average of the bond rate.

Money supply is defined as:

$$(3.7) \qquad M_S = a(R + D)$$

where:

$M_S$ = the stock of domestic money

a = the money multiplier

R = international reserves

D = domestic influences on the balance sheet

By using the assumption of equality of money supply and demand, he derives the estimated form of the reserve flow equation:

$$(3.8) \quad \left(\frac{R}{H}\right) g_R = a_1 g_Y - a_2 g_i + b_1 g_p - b_2 g_a - b_3 \left(\frac{D}{H}\right) g_D + e$$

where:

$H - R + D$

$g$ = the rate of growth of the respective variables

$e$ = stochastic error term

In the estimation, he used a definition of money that is approximately equal to $M_2$. The model was estimated using quarterly, semiannual, and annual data; it turned out that the annual regressions yielded the best fit. The estimated coefficients conformed to the hypothesis, i.e., they fell within two standard deviations of their expected values, with + 1.0 for the price and income variables and - 1.0 for the multiplier and the domestic credit variables. The interest rate variable was not significantly different from zero, but it had its expected negative sign. Based on his findings Zecher concludes that his study supports the monetary approach to the balance of payments.

H. A. Genberg studied the case of Sweden (14, 1976). His study started out by examining the assumptions of the monetary model and the integrated market hypothesis was tested for the goods and the capital markets. For the goods sector, he conducted several tests, one of which was to compare the rates of inflation between the OECD countries with the variations in the rates of inflation between the different states in the United States. The result of this test was that there is no more variation between the OECD countries than there is between different states. On this basis, he claimed that it is

just as permissible to treat the OECD countries as one market as it is to treat the United States as one market. He also estimated a regression where the Swedish rate of inflation is defined as a function of the world rate of inflation. He had to reject the hypothesis that the coefficient for the world rate of inflation was + 1.0. He concluded that the integrated market hypothesis can be accepted for the goods sector for the case of Sweden. He tested the integrated market hypothesis for the capital sector as well, and in spite of the many capital regulations that exists in Sweden, he found that he could not reject the integrated market hypothesis. He defined the money supply function in the same manner as Zecher, i.e.,

(3.9) $M = a\,H$

where:

H = high powered money, and

a = the money multiplier

He distinguished between the short-run and the long-run money demand function, where short-run demand function was defined as a lagged adjustment process between the desired and the actual demand in the preceding period. The long-run demand function is specified as:

(3.10) $\left(\frac{M}{P}\right)_t^* = k\, Y^{k_1} i^{k_2}$

where

k = a constant

the rest of the variables are as defined earlier

Based on these relationships, the estimated reserve flow equation is derived:

(3. $\left(\frac{R}{H}\right) g_R = g_M^D - g_a - \left(\frac{D}{H}\right) g_D$

The estimated reserve flow, using equation (3.11) is then compared with the actual reserve flow. Genberg found a high correlation between these. This result supports the monetary approach. Genberg estimated equation (3.11) using both the broad and the narrow definition of money. At the end of the paper, he dealt with the possibility of a simultaneous equation bias as a result of domestic credit being a function of the reserve flow as well as the reserve flow being a function of the domestic credit creation. To test for this possibility, he presents a simultaneous equation model where domestic credit is a function of international reserves and government debt outstanding. International reserves are defined as a function of domestic credit, the money multiplier, prices, income, the interest rate and money in the previous period. Estimation of this system showed that the specification of the reaction equation was inadequate, but the expected values for the reserve flow equation were still obtained.

D. Bean (2, 1976) studied the case of Japan, She used the general specification of the demand for money function. The estimated reserve flow equation is identical to that estimated by Zecher, but in addition she redefined the dependent variable by dividing through $(\frac{R}{R+D})$. The period of study is 1950-1970. Her results showed that all the variables had their predicted signs.

Guitian (15, 1976) studied the case of Spain in the period 1955-1971. He regressed changes in the balance of payments and changes in the current account on different measures of domestic credit, then he proceeded to estimate the balance of payments and the balance on the current account as functions of gross domestic product, Spain's cost of living index, an index of foreign prices and one of the different

measures of domestic credit. He found that the only significant variable was that of domestic credit. He gave institutional evidence that government was acting to sterilize the reserve flow, but he did not take this into consideration in the estimation.

Two studies, one by M. Cox and S. Wilford (8, 1976) and another by M. Cox (7, 1976), extend the basic monetary reserve flow model by explicitly incorporating world equilibrium conditions. The study by Cox and Wilford estimates the ordinary reserve flow equation as well as the alternative reserve flow equation:

$$(3.12)\quad \frac{R(z)}{H(z)}\, g_{R(z)} = b_1 \left(g_{Y(z)} - g_{Y(f)}\right) - b_2 g_{i(z)} - b_3 \left(g_{a(z)} - g_{a(f)}\right) + c_4 \frac{D(f)}{H(f)}\, g_{D(f)} - b_4 \frac{D(z)}{H(z)}\, g_{D(z)} + v$$

where:

z = the home country

f = the rest of the world

the rest of the definitions are as defined earlier

This equation builds on the small country assumption and assumes further that there is no growth in total world reserves. The model was tested on the case of Mexico and Canada. In both instances the United States was regarded as the rest of the world. The estimation for Mexico used annual data for the period 1954-1974 and the Canadian study used quarterly data for the period 1963-69. Their empirical results of both the traditional and the alternative reserve flow equation strongly supported the monetary approach.

Cox (7, 1976) started out with the same basic model as in the above study, but instead of assuming immediate perfect information about foreign variables, he assumed that people in country z formed

rational expectations about these parameters and acted in accordance with these. His estimated equation, in addition to the two already mentioned is:

$$(3.13)\quad \frac{R(z)}{H(z)}\, g_{R(z)} = -(b_2 - c_2)\, g_{i(z)} - b_i\,(g_{Y(z)} - \bar{g}_{Y(f)}) - (g_{a(z)} - \bar{g}_{a(f)}) + \frac{D(f)}{H(f)}\,(u_f - q\,\frac{o_f}{o_z}\,u_z) - (\frac{D(z)}{H(z)} - \frac{D(f)}{H(f)}\,q\,\frac{o_f}{o_z})\, g_{D(z)}$$

where:

$u_z = \bar{g}_{D(z)}$ = the average (to date) periodic rate of credit creation by the monetary authorities of country z

$u_f = \bar{g}_{D(f)}$ = the average (to date) periodic rate of credit creation by the monetary authorities by country f

$q$ = the correlation between the growth in domestic credit and the growth in foreign credit

$o_z$ = the variance in the rate of domestic credit creation

$o_f$ = the variance in the rate of foreign credit creation

Estimating the three forms of the reserve flow equation for Canada, using the United States as a proxy for the rest of the world, he found that the monetary model was supported by all of them. He further concluded, on the basis of an F test, that the expectations model was superior to the other two models. The standard reserve flow equation was also estimated for the case of Mexico by S. Wilford and R. Zecher (26, 1976) and by S. Wilford (25, 1976) in his Ph.D. dissertation. Both these studies supported the monetary approach.

All the foregoing studies have employed time series data from a single country. M. Connolly and D. Taylor (5, 1976) have tested the monetary approach using cross-sectional data. They define the demand for money equation as:

$$(3.14)\quad L = kpY$$

where:

L = the demand for money

k = a constant

p = home prices

Y = permanent income

The supply of money:

(3.15) $M = R + D$

M = the supply of money

R = international reserves

D = domestic credit

and the purchasing power parity

(3.16) $p = rp^*$

where:

r = the exchange rate

$p^*$ = foreign prices

They then assumed no change in the rate of growth of permanent income measured at world prices as a result of the devaluation. On these assumptions, they derived the estimated function:

$$(3.17) \quad \left(\frac{B_t}{M_t} - \frac{B_{t-1}}{M_{t-1}}\right) = b_1 \frac{\Delta r_t}{r_t} + b_2 \left(\frac{\Delta D_t}{M_t} - \frac{\Delta D_{t-1}}{M_{t-1}}\right) + u$$

where:

B = the balance of payments

The regression sample consists of 17 developing and 10 developed countries. The estimation results indicated that devaluation does improve the balance of payments. They further do not reject the hypothesis that $b_2 = -1$. Connolly and Taylor then proceeded to deal

with the sterilization question. The sterilization process is represented by the equation:

$$(3.18) \quad \left(\frac{\Delta D_t}{M_t} - \frac{\Delta D_{t-1}}{M_{t-1}}\right) = a\left(\frac{B_t}{M_t} - \frac{B_{t-1}}{M_{t-1}}\right) + v$$

If this relationship was true, it would imply a downward bias in the estimates of $b_1$ and $b_2$ above. To get direct evidence of sterilization (3.18) was estimated using a two-stage least squares procedure. The results indicated that sterilization takes place in developed countries. The study as a whole supports the domestic credit aspect of the monetary model.

M. Connolly and D. Taylor (6, 1976) conducted another cross sectional study concentrating on developing countries. The model used was the same as that mentioned in the foregoing study. The data were taken from 18 independent devaluations in the period 1959-70. The estimation results fail to reject the hypothesis that the coefficient of domestic credit expansion equals - 1. The hypothesis of the coefficient for the rate of devaluation being greater than 1, however, must be rejected. The reason for this result may be a bias as a result of relaxation of restrictions in connection with the devaluation and error in variables may also account for this result.

Genberg (13, 1976) incorporated a testing of the monetary approach in his comparison study of the three approaches to the balance of payments. He allowed the domestic price level to adjust slowly to the new level implied by the purchasing power parity, except for this, his model is identical to that of M. Connolly and D. Taylor. He does not assume unchanged prices and income. The empirical results, using data from 17 countries, show that the coefficient for domestic credit conforms to the hypothesis.

# CHAPTER IV

## THE INTEGRATED MARKET HYPOTHESIS, THEORETICAL MODEL AND EMPIRICAL RESULTS

### Theoretical Development and Review of Some Empirical Studies

The monetary approach to the balance of payments assumes that the integrated market hypothesis holds. This may not be so as two empirical studies of the hypothesis reached opposite conclusions. Genberg (14, 1976) found support for the integrated market hypothesis in the case of Sweden, but Bordo and Choudhri (3, 1976) rejected the hypothesis in their study of Canada.

The integrated market hypothesis for the goods market, in its simplest form, can be expressed by the purchasing power parity relationship in its absolute form:

(4.1) $p = p^* e$

where:

$p$ = home price

$P^*$ = foreign price

$e$ = exchange rate

If we allow for the presence of import and/or export taxes and subsidies, we have to move to the relative version of the purchasing power parity, and we will have the following relationship:

$$(4.2) \quad \frac{\Delta p}{p} = \frac{\Delta p^*}{p^*} \quad e,$$

where:

$\Delta$ = the change in the variable.

This means that the rate of inflation will be equal in the countries, even if their price levels can differ. This model still builds on the simplifying assumptions that all goods are traded and, if we are looking at an aggregate price index movement, that the weighting schemes are equal. If we are dealing with the short-run, we would want to divide the market into traded and nontraded goods, with the relationship derived in from holding only for traded goods. The price of nontraded goods in the short-run then would be determined by domestic supply and demand conditions.

Genberg (14, 1976) looked at the aggregate rate of inflation for Sweden relative to the world rate of inflation. He divided the time period 1959 to 1970 into three groups and tested for equality of inflation rates using an F test. He rejected the hypothesis of differing inflation rates for two of the periods. Next, he carried out a comparison between inflation rates among different U.S. cities and found these to differ just as much as between the OECD countries. Thus, he argues that it is reasonable to accept the integrated market hypothesis. Finally, since Sweden is a small country, the unified market hypothesis implies that Swedish prices are given by the world prices. He regressed the Swedish rate of inflation on the world rate of inflation, using an average of the inflation rate in fifteen other countries as a measure of the world rate of inflation. His estimates are somewhat low for the coefficient of world inflation, but he still contends that his results support the integrated market hypothesis. This conclusion

may be questionable as the hypothesis of the world inflation rate being + 1.0 had to be rejected, but based on his additional evidence he seems to be justified in drawing the conclusion.

Bordo and Choudhri (3, 1976) on the other hand, do not look at an aggregate price index, but at the rate of change in price for specific selected commodities. They distinguish between the short-run and the long-run relationships and develop a model for each. The estimated short-run model is:

$$(4.3) \qquad \text{Log } p_i = A_0 + A_1 \text{ Log } p_i^f + A_2 \text{ Log } E + A_3 \text{ Log } \bar{p} + u_i$$

where:

$p_i$ = price of commodity i

$p_i^f$ = United States' price of commodity i

$E$ = the exchange rate

$\bar{p}$ = aggregate price level, entered to represent domestic demand and supply.

The integrated market hypothesis leads us to expect $A_1 = A_2 = 1.0$ and $A_3 = 0$ for traded goods and $A_1 = A_2 = 0$ and $A_3 = 1.0$ for nontraded goods. The estimation results using Canadian data, did not support these hypotheses except in the case of two commodities. In the long-run, if the integrated market hypothesis holds, we would expect the ratio of home to foreign exchange rate adjusted price to tend to a constant mean value. To test this, they estimated the following regressions:

$$(4.4) \qquad r_t = \phi_1 r_{t-1} + s + u_t$$

and

$$(4.5) \qquad r_t = \phi r_{t-1} + s + u_t + u_{t-1}$$

where:

$r_t$ = Log $p_t$ - Log $p_t^f$ - Log E

$u_t$ = stochastic disturbance term

s = constant term

The stability condition is that $|\phi| < 1.0$.

The empirical results showed values of $\phi$ very close to 1.0, which indicates a slow adjustment process. On the basis of their findings, they concluded that the integrated market hypothesis is not supported in the case of Canada.

To test the integrated market hypothesis for the case of Norway, I will estimate the relationship between home and world inflation rates, which was used by Genberg in his study of Sweden. The method suggested and used by Bordo and Choudhri will not be attempted, this is not because of theoretical considerations, but because of practical problems. It is hard to find corresponding world prices for the commodity groups for the case of Norway as this country does not have one dominant trade partner but rather several partners having about equal shares of the trade volume. Genberg estimated the Swedish rate of inflation as a function of world rate of inflation, since there does not exist any "official" world rate of inflation a proxy measure had to be constructed for this purpose. Genberg used an average of inflation rates in 15 different countries. The proxy variables to be used in this study will be a weighted and an unweighted average of the rate of inflation in the ten countries that are Norway's major trade partners. The weights used for the weighted average variable will be that country's share of Norway's exports and imports. The following countries and their respective weights will be included in the calculation of the weighted world inflation rate.

TABLE IV.1

WEIGHTS OF MAJOR TRADE COUNTRIES' EXPORTS AND IMPORTS WITH NORWAY

| | Country | Weight |
|---|---|---|
| 1. | Great Britain and North Ireland | 19.6% |
| 2. | West Germany | 20.8% |
| 3. | Sweden | 24.0% |
| 4. | Denmark | 8.4% |
| 5. | The United States | 8.6% |
| 6. | France | 3.9% |
| 7. | The Netherlands | 4.2% |
| 8. | Finland | 3.1% |
| 9. | Italy | 2.8% |
| 10. | Canada | 4.6% |

Source: Statistisk Aarbok 1973, Statistisk Sentralbyraa, Oslo, Norway 1973. (The data used are from 1970).

The integrated market hypothesis assumes no change in trade restrictions. Changes in trade restrictions will influence the relationship between home price inflation and world price inflation. During the period 1955 to 1970, there was a general tendency to decrease the barriers to trade between Norway and the rest of the world. These decreases came about partially as a result of the GATT agreements and partially through Norway's membership in EFTA in 1960. Additional agreements were reached with other countries, including the East European countries, The relaxation of trade restrictions is discussed more fully in the chapter describing Norway's economic development.

This change in trade restrictions should be included in the model, which would imply the following model:

$$(4.6) \quad g_p = a_0 + a_1 \text{ WINF} + a_2 \text{ TR} + u'$$

where:

$g_p$ = the Norwegian price inflation

WINF = the world price inflation

TR = trade restrictions

$u'$ = stochastic disturbance term

TR is a variable that it is very hard to measure as the variations in trade restrictions are of such a wide variety. If we then leave this variable out of the model, as it is done both in the study by Genberg (14, 1976) and in this study, we have an omitted variable problem. The estimated model is:

$$(4.7) \quad g_p = a_0' + a_1' \text{ WINF} + u''$$

We then know that:[1]

$$E(a') = a_1 + a_2 d_{12}$$

where $d_{12}$ is the regression coefficient in the "auxiliary" regression of TR on WINF. Thus, it is clear that the direction of the bias depends on the sign of the omitted variable and the direction of the correlation between the omitted and the included variable. If we can obtain a reasonable idea of these factors, then we can tell the direction of the bias. The coefficient $a_2$ of trade restrictions in the "correct" equation is expected to be positive, that is, an increase in trade restrictions would tend to increase the domestic price level. When it comes to the relationship between trade restrictions and the world

price level, we would expect a negative correlation at least for the case of protective tariffs in the short-run. A low world price relative to the Norwegian price would induce a high tariff to protect the domestic sector. On these expectations, we would have $a_2 d_{12} < 0$, which would imply:

$$E(a_1) = a_1 + a_2 d_{12} < a_1,$$

that is, the estimation of the relationship leaving out the trade restriction variable will bias the world inflation coefficient downwards. The calculated variances also will be biased and the significance tests will no longer be correct, they will be too conservative. In spite of these problems, the equation of the Norwegian price inflation as a function of the world price inflation will be estimated, but it will be wise to remember that there exist some problems with the model.

The Integrated Market Hypothesis: Empirical Results

As mentioned in the theoretical part, the assumption that the integrated market hypothesis holds is an essential part of the monetary model. This hypothesis is tested for the goods market using the relative version of the purchasing power parity. This approach builds on the assumption of equal weighting schemes being used in the different countries when composing the price index. This is not so, and this fact will bring some disturbance into the relationship. Another factor that would account for different development of the price index, is the presence of nontraded goods. This last problem arises from using the consumer price index movement as a measure of the price movement, but this index seems to be the best available in spite of this problem.

For Norway the problem with nontraded goods is likely to be very small since most goods would fall into the traded goods group. A bigger problem is the price differences that may exist due to Norway's large and fairly heavily changing proportion of tariffs, quotas and subsidies. This was discussed in the previous part of the chapter. The central tendency, during the 1955-1970 period, has been to decrease these different trade restrictions, this should result in a closer price level movement with the rest of the world.

Since Norway does not have a single dominant trade partner, it was necessary to construct a measure of world inflation. Two similar measures were constructed:

1. A weighted average of the inflation rates in the ten major trade partners' countries. The weights used being that country's share of trade with Norway.
2. A simple average of the inflation rates in the same countries as in 1.

World inflation is thus defined as:

(4.8) WINF = ((CPID * 8.4) + (CPIS * 24.0) + CPIGB * 19.6) +
(CPIWG * 20.8) + (CPIUS * 8.6) + (CPIC * 4.6) +
(CPIF * 3.9) + (CPII * 2.8) + (CPIH * 4.2) +
(CPIFI * 3.1))/100

or

(4.9) WI = (CPID + CPIS + CPIGB + CPIWG + CPIUS + CPIC + CPIF +
CPII + CPIH + CPIFI)/10

where:

WINF = the rate of world inflation, weighted

WI = the rate of world inflation, unweighted

CPID = the rate of inflation in Denmark

CPIS = the rate of inflation in Sweden

CPIGB = the rate of inflation in the United Kingdom

CPIWG = the rate of inflation in West Germany

CPIUS = the rate of inflation in the United States

CPIC = the rate of inflation in Canada

CPIF = the rate of inflation in France

CPII = the rate of inflation in Italy

CPIH = the rate of inflation in the Netherlands

CPIFI = the rate of inflation in Finland

The unified market hypothesis postulates that the rate of inflation in Norway is a function of the world rate of inflation. Let $g_p$ be the rate of inflation in Norway, we then have the following model, which was estimated by ordinary least squares:

$$(4.10) \quad g_p = a_0 + a_1 \text{ WINF} + u$$

where:

u - the stochastic disturbance term

The integrated market hypothesis leads us to expect the constant term to be close to zero, and the coefficient of world inflation to be + 1.0. The model, (4.10), was estimated for the time period 1955 to 1970 using annual data, the estimation yielded the following results:

$$(4.11) \quad g_p = -.008 + 1.35 \text{ WINF}$$
$$\qquad\quad (.02) \quad (.41)$$
$$R^2 = .45$$
$$\text{Durbin-Watson statistic} = 2.28$$

The standard error is reported under the coefficient. Testing the hypothesis that the constant term is zero, tells us that we cannot reject this hypothesis at the .05 level of significance. The world

inflation rate enters with a coefficient of 1.35 and a standard error of .41, thus, we cannot reject the hypothesis that this coefficient is + 1.0, as expected, at the .05 significance level. The Durbin-Watson statistic is 2.28, we thus cannot reject the hypothesis of no autocorrelation.

Equation (4.10) was also estimated using the alternative measure of world inflation, that is, the unweighted variable defined in equation (4.9). Estimation of this relationship for the time period 1955 to 1970 gave the following result:

(4.12) $g_p = -.01 + 1.35\ WI$

$\quad\quad\quad

Norway during the time period 1955 to 1970, which implies that the Norwegian price inflation can be taken to be exogenously determined in our reserve flow model.

Equation (4.10) was tested for the time period 1955 to 1970. The estimation, using definition (4.8) of world inflation, yielded the following estimates:

(4.13) $g_p = .006 + .89\ WINF$

$(.02)\quad (.48)$

$R^2 = .31$

Durbin-Watson statistic - 2.07

The constant term enters with a value of .006 and a standard error of .02. On this basis, we cannot reject the hypothesis of its being zero at the .05 level of significance. The world inflation variable is not significantly different from + 1.0 at the .05 level of significance. The Durbin-Watson statistic tells us that we cannot reject the hypothesis of no autocorrelation at the .05 significance level. Equation (4.10) was also estimated for the subperiod 1955 to 1965 using the unweighted measure of world inflation. This estimation gave the following results:

(4.14) $g_p = .001 + .98\ WI$

$(.02)\quad (.44)$

$R^2 = .38$

Durbin-Watson statistic = 2.77

The single hypothesis of the constant's being zero and the single hypothesis of coefficient of world inflation being + 1.0 cannot be rejected at the .05 level of significance. The Durbin-Watson statistic implies that the hypothesis of no autocorrelation cannot be rejected at the .05 level of significance. Comparing the estimation results of

equations (4.13) and (4.14) indicates that neither leads to rejection of the hypothesis concerning their coefficients. The coefficient for the unweighted measure of world inflation is somewhat larger than the coefficient for the weighted measure of world inflation: .89 as compared with .98. The $R^2$ obtained using the weighted world inflation measure was .31 as compared with an $R^2$ of .38 for the equation using the unweighted measure of this varialbe. Both of these equations, as well as those for the whole time period, support the integrated market hypothesis.

To avoid the averaging effect in the above approach, further estimation was carried out using the rate of inflation in two major trade partner countries. The countries chosen were the United Kingdom and West Germany, each having 19.4% and 20.8%, respectively, of the value of trade. The reason for not choosing Sweden, which is the largest trade partner, is the fact that Sweden itself, to a much larger extent than the chosen countries, can be regarded as a small country. The following models were estimated:

$$(4.15) \quad g_p = a_1 + a_2 \, CPIGB + u$$

and

$$(4.16) \quad g_p = b_1 + b_2 \, CPIWG + u'$$

where:

CPIGB = the rate of inflation in the United Kingdom

CPIWG = the rate of inflation in West Germany

For the time period 1955 to 1970, the estimation of equation (4.15) yielded the following results

(4.17) $g_p = .01 + .81\ CPIGB$

$(.01)\ (.28)$

$R^2 = .39$

Durbin-Watson statistic = 2.00

The hypothesis of the constant term being zero cannot be rejected since the coefficient is .01 and the standard error is .01. The coefficient for the inflation rate in the United Kingdom is .89 with a standard error of .28, which implies that we cannot reject the hypothesis that this is + 1.0 at the .05 level of significance. Equation (4.16) was also estimated for the time period 1955 to 1970, this estimation gave the following results:

(4.18) $g_p = .01 + 1.23\ CPIWG$

$(.02)\ (.65)$

$R^2 = .22$

Durbin-Watson statistic = 2.07

The hypothesis of the constant's being zero was not rejected at the .05 level of significance. The West German rate of inflation entered with a coefficient of 1.23 and a standard error of .65; we, thus, cannot reject the hypothesis that this coefficient is + 1.0 at the .05 significance level. Using the inflation rates in these two countries as a proxy variable for the world rate of inflation yielded estimates of the coefficients that are supportive of the integrated market hypothesis. Compared with the regressions using the constructed average measures of world inflation, equations (4.8) and (4.9), the explanatory power dropped in equations (4.16) and (4.17) as compared with the $R^2$'s obtained in equations (4.11) and (4.12). The coefficient for the world

inflation rate was close to the expected value of + 1.0 in all the regressions. The constant term was not significantly different from zero in any of the regressions, and this is what theory predicts.

As a conclusion of these tests it seems that the integrated market hypothesis holds for the case of Norway.

## Notes

[1]Proof of this relationship can be found in G. S. Maddala, Econometrics, p. 156.

## CHAPTER V

## THE MONETARY MODEL: THEORY AND EMPIRICAL RESULTS

As we have seen earlier, the most common approach has been to define single euqation models of the balance of payments. I will develop both a single equation model and a simultaneous equation model.

1. Single Equation Model

Like most other studies, the present model will build on the monetary model developed by Johnson (18, 1976). The model is based upon the following assumptions:

1. The small country assumption holds.
2. The purchasing power parity holds.
3. The adjustment process is instantaneous such that money supply equals money demand.

The money supply can be defined as:

(5.1) $M_s = R + D_i$

where:

$M_S$ = money supply demand

R = international reserves

D = domestic credit

i = 1, 2 indicating which definition of domestic credit is being used.

1 = the narrow definition, i.e., $M_1$

2 = the broad definition, i.e., $M_2$

The money demand function is defined in general terms as a function of the interest rate and income. For simplicity, this function is assumed to be homogeneous of degree one in prices. We have:

(5.2) $M_d = p\ f(Y,i)$

where:

$M_d$ = demand for money

P = home price level

Y - permanent income

i = interest rate

The purchasing power parity gives the following relationship:

(5.3) $p = r\ p^f$

where:

r = the exchange rate

$p^f$ = foreign price

In this case r is constant over the period in question, thus the growth in p will be equal to the growth in $p^f$ and we can ignore the difference between p and $p^f$.

The assumption of instantaneous adjustment allows us to equate the money supply and the money demand, i.e.,

(5.4) $M_s = M_d$,

which can be rewritten as:

(5.5) $R + D_i = p\ f(y,i)$

Now rearrange the terms in (5.5) by moving $D_i$ to the right hand side of the equation and differentiate logarithmically to get:

$$(5.6) \qquad \left(\frac{R}{R+D_i}\right) d \text{ Log } R = d \text{ Log } P = + n_Y \, d \text{ Log } Y + n_i \, d \text{ Log } i - \left(\frac{D_i}{R+D_i}\right) d \text{ Log } D_i,$$

where:

$n_Y$ = the elasticity of demand for money with respect to income

$n_i$ = the elasticity of demand for money with respect to interest

Now, (5.6) can be estimated as:

$$(5.7) \qquad \left(\frac{R}{R+D_i}\right) d \text{ Log } R = A_1 d \text{ Log } p + A_2 d \text{ Log } Y + A_3 d \text{ Log } i - A_4\left(\left(\frac{D_i}{R+D_i}\right) d \text{ Log } D_i\right) + e$$

Equation (5.1) can also be expressed in growth terms where:

$$g_x = \frac{1}{x} \frac{dx}{dt}, \quad x = R, D_i, Y, i.$$

We then get the equation:

$$(5.8) \qquad \left(\frac{R}{R+D_i}\right) g_R = a_1 g_p + a_2 g_Y + a_3 g_i - a_4 \left(\frac{D_i}{R+D_i}\right) g_{D_i} + e'$$

Equation (5.8) is the specification of the reserve flow equation that will be used in the empirical testing of the model. This equation will frequently be referred to as the basic model. The reason for wanting to use more than one specification of domestic credit rests on the fact that some doubt has been raised by Norwegian economists as to whether $M_1$ is a proper definition of money in the Norwegian case. The question is now being addressed

by the Bank of Norway and the Department of Finance. The major reason for expecting a wider definition to do better is the existence of a special arrangement for people's salaries/wages to be deposited directly into an interest bearing account. The interest rate obtained on these accounts is only slightly lower than the lowest time deposit interest rate. Further, a special kind of cash check can be drawn on some of the time deposits. Thus there is no clearcut division between demand and time deposits as far as liquidity is concerned.

2. Single Equation Model Explicitly Incorporating World Monetary Equilibrium

The traditional monetary model, as developed in the previous section, takes account of the world monetary equilibrium only in so far as it affects prices and the interest rate. These are assumed exogenous, i.e., given by the world conditions. In this section I will develop a model that explicitly incorporates world money supply and demand. Work in this area has been done by M. Cox and S. Wilford (8, 1976) (7, 1976). This model can also be extended to take into account lags in information transmission from foreign countries.

The Model

For the home country, which will be denoted by the subscript z, we have the following relations:

(5.9) $M_d(z) = p(z)\, f_z\,(Y(z), i(z))$

(5.10) $M_s(z) = R(z) + D_i(z)$

(5.11) $M_s(z) = M_d(z)$

In addition, we retain the assumptions of interest rate parity and and purchasing power parity.

The world monetary equilibrium can be described by the following relations, where w denotes the world and f = w - z:

(5.12) $M_d(w) = M_d(z) + M_d(f) = p(z)\ f_z(Y(z),i(z)) + p(f)\ f_f(Y(f),i(f))$

(5.13) $M_s(w) = M_s(z) + M_s(f) = R(z) + D_i(z) + R(f) + D_i(f)$

(5.14) $M_s(w) = M_d(w)$

all variables were define in the previous section.

From the first three equations, we get our familiar reserve flow equation:

(5.15) $$\frac{R(z)}{M_i(z)}\ g_{R(z)} = a_1 g_{p(z)} + a_2 g_{Y(z)} + a_3 g_{i(z)} + a_4\ \frac{D_i(z)}{M_i(z)}\ g_{D_i(z)}$$

where:

$M_i = R(z) + D_i\ (z)$

The condition of world monetary equilibrium, $M_d(w) = M_s(w)$, provides the following relationship in growth terms:

(5.16) $$\frac{M(z)}{M(w)}\ (g_{p(z)} + a_2 g_{Y(z)} + a_3 g_{i(z)}) + \frac{M(f)}{M(w)}\ (g_{p(f)} + b_2 g_{Y(f)} +$$

$$b_3 g_{i(f)}) = \frac{M(z)}{M(w)}\ (\frac{D_i(z)}{M_i(z)}\ g_{D_i(z)} + \frac{R(z)}{M_i(z)}\ g_{R(z)} +$$

$$\frac{M(f)}{M(w)}\ (\frac{D_i(f)}{M_i(f)}\ g_{D_i(f)} + \frac{R(f)}{M_i(f)}\ g_{R\ (f)})$$

On the small country assumption, we can simply by setting

$$\frac{M(z)}{M(w)} = 0 \text{ and } \frac{M(f)}{M(w)} = 1.$$

Further, assume that there is no growth in reserves worldwide, i.e.,

$$\frac{M(z)}{M(w)} \quad \frac{R(z)}{M_i(z)} \quad g_{R(z)} = - \quad \frac{M(f)}{M(w)} \quad \frac{R(f)}{M_i(f)} \quad g_{R(f)}$$

Now the above equation can be rewritten as:

$$(5.17) \qquad g_{p(f)} + b_2 g_{Y(f)} + b_3 g_{i(f)} = \frac{D_i(f)}{M_i(f)} \, g_{D_i(f)}$$

From the asumption of price and interest rate parity, this is again equal to:

$$(5.18) \qquad g_{p(z)} + b_3 g_{i(z)} = - b_2 g_{Y(f)} + \frac{D_i(f)}{M_i(f)} \, g_{D_i(f)}$$

Equation (5.18) tells us what determines price and interest rates in the home country z. We can now use this knowledge by substituting it into our home country reserve flow equation. Doing this, we end up with the following:

$$(5.19) \qquad \frac{R(z)}{M_i(z)} \, g_{R(z)} = a_2 g_{Y(z)} - b_2 g_{Y(f)} + \frac{D_i(f)}{M_i(f)} \, g_{D_i(f)} + a_4 \, \frac{D_i(z)}{M_i(z)} \, g_{D_i(z)}$$

From the above equation we see that an expansion in foreign credit will increase the level of reserves in the home country. In our earlier model this effect was transmitted through the price and the interest rate variables. Equation (5.19) will be estimated in the above form and it will also be estimated under the restriction that the coefficients of $a_2$ and $b_2$ are equal.

## Reserve Flow Equations: Empirical Results

### Single Equation Estimates

The general form of the basic reserve flow equation is given by:

$$(5.20) \qquad \frac{R}{R+D_i} \, g_R = a_1 g_p + a_2 g_Y + a_3 g_i + a_4 \left(\frac{D_i}{R+D_i}\right) g_{D_i} + e$$

where:

R = international reserves

p = price

Y = income

i = interest rate

$D_i$ = domestic credit,

i (subscript) = 1, if money is narrowly defined

= 2, if money is broadly defined

g = the growth rate of the respective variables

e = the stochastic error term

The measure for the price variable is the consumer price index, which is commonly used and is easily available. The problems associated with it were discussed in the chapter on the integrated market hypotheiss. Two measures are used for the income variable, permanent income and current income. Both measures use the price index adjusted GNP for Norway, permanent income is then calculated as a five-year moving average of this price adjusted GNP. Because of the effects of the 1949 devaluation and the general post-war effects on the Norwegian economy, 1955 is the first year for which permanent income will be calculated.

The interest rate variable is the government bond yield, which may not accurately measure the market rate of interest as the Norwegian government places strict regulations on the bond rate as well as on all other interest rates. In spite of these problems, however, the government bond yield still seems to be the best obtainable variable. This variable is also comparable to the measure used by Zecher in his study on Australia (27, 1976). All the data used in the estimation of equation (5.20) come from the International Financial Statistics (17).

The monetary model leads us to expect $a_1$, the price coefficient, to be + 1.0. Since prices in Norway are measures of world prices by the integrated market hypothesis, a price increase will induce a reserve inflow. The value of $a_2$, the income variable, is expected to be + 1.0; the value of $a_4$, the domestic credit varialbe, - 1.0; and the value of $a_3$, the interest rate variable, is expected to be negative. This basic reserve flow equation has been estimated using different measures for several of the variables and it has also been estimated for two different time periods. The results for each of these cases will be reported below.

1. Estimation of the reserve flow equation (5.20) for the period 1955 to 1970 using the narrow definition of money and permanent income, yielded the following estimates:

(5.21)[1] $$\frac{R}{M1} g_R = \underset{(.25)}{.64}\, g_Y - \underset{(.07)}{.02}\, g_i + \underset{(0.46)}{0.18}\, g_p - \underset{(.16)}{.65}\, \frac{D_i}{M1} g_{D_1}$$

$R^2 = 0.63$ [2]

Durbin-Watson statistic = 1.91

M1 = R + D1

The coefficient of permanent income, .64, is not significantly different from its expected value of + 1.0 at the .05 level of significance. The interest rate coefficient has the expected negative sign and is of a magnitude comparable to that obtained in other studies. The price coefficient is quite low and not significantly different from zero at a .05 level of significance. It has, however, a large standard error of .46. Because of this the hypothesized value of + 1.0 will fall within two standard deviations of the point estimate. The theoretically

important domestic credit variable has a coefficient of .65 and we can reject the hypothesis of its being equal to - 1.0 at the confidence level of .05. The confidence interval is however, - .31, - .99, thus the coefficient is very close to being significant at this level. All the hypotheses have been tested separately. Thus, one may draw inference about one of the variables, but we cannot combine the tests and say anything about several of the coefficients at the same time without simultaneously changing the significance level.

To be able to test the complete monetary hypothesis, we have to make use of the fact that:

$$(5.22) \qquad F = \frac{(RRSS - URSS)/R}{URSS/n-k-1}$$

where:

RRSS = restricted residual sum of squares

URSS = unrestricted residual sum of squares

R = number of restrictions

n = number of observations

k = number of parameters

has an F-distribution with R,n-k-1 degrees of freedom. The joint hypothesis to be tested is that the income variable's coefficient and the price coefficient are + 1.0 and the domestic credit variable's coefficient is - 1.0. This hypothesis can then be written as:

$$H_0 : a_1 = + 1.0,\ a_2 = + 1.0,\ a_4 = - 1.0$$

against

$$H_1 : a_1 \neq + 1.0,\ a_2 \neq + 1.0,\ a_4 \neq - 1.0$$

The calculated F value is then:

$$(5.23) \qquad F = \frac{(0.047 - 0.010)/3}{(0.010/15-4-1)} = 12.0$$

The table value of $F_{3.10} = 3.71$ at the .05 significance level. At the .10 level of significance, we cannot reject the null hypothesis if $.11 < F < 3.71$. Since our calculated F is 12.0, it follows that we have to reject the hypothesis that $a_1 = +1.0$, $a_2 = +1.0$ and $a_4 = -1.0$. These results do not give too much support to the monetary model, the joint hypothesis had to be rejected, and the estimated coefficients were far from their expected values. Equation (5.21) obtained a Durbin-Watson statistic of 1.91 which implies that we cannot reject the hypothesis of no autocorrelation at the .01 significance level. At the .05 level the obtained value falls in the inconclusive region. This test is of particular importance since the estimation is carried out using time series data. The $R^2$ was fairly high: viz., .63

2. Estimation of the reserve flow equation (5.20) for the period 1955 to 1970 using the broad definition of money and using permanent income.

The broad definition of money, that is, including quasi-money, was introduced into the model on the expectation that this definition might be more appropriate for the case of Norway. The reason for this expectation is the fact that there exist interest bearing accounts with checking rights.[4] These accounts are widely used by employers as their way of paying wages and salaries to their employees. But, in spite of these special factors, the broad definition of money did not yield a better fit. Specifically, the estimation on results were:

$$(5.24)^5 \quad \frac{R}{M2} g_R = \underset{(0.20)}{0.40}\, g_Y + \underset{(0.04)}{0.02}\, g_i + \underset{(0.28)}{0.21}\, g_p - \underset{(0.19)}{0.40}\, \frac{D_2}{M2} g_{D_2}$$

$R^2 = 0.32$

$\bar{R}^2 = 0.05$

Durbin-Watson statistic = 1.90

where:

$M2 = R + D_2$

The permanent income coefficient is .40 with a standard error of .20, we have to reject the hypothesis of its being + 1.0. Interestingly, compared to the coefficient for permanent income obtained in equation (5.21) using the narrow definition of money, this coefficient is further away from the hypothesized value. The interest rate variable is positive instead of negative as predicted by the monetary model. The standard error, however, is twice the size of the coefficient so the coefficient is clearly not significantly different from zero. The price variable enters with the expected positive sign, but with a coefficient of .21 and a standard error of .27, we have to reject the hypothesis of its being equal to + 1.0 at the .05 level of significance. The domestic credit variable coefficient is lower in absolute value than the domestic credit coefficient obtained in equation (5.21), using the narrow definition of money. In addition, its standard error has increased. The hypothesis of the coefficient for the domestic credit variable being - 1.0, must be rejected at the .05 significance level for the broad definition of money. Thus, these tests lend virtually no support to the monetary approach to the balance of payments.

The Durbin-Watson statistic tells us that there is no evidence of autocorrelation at the .01 significance level. Based on the foregoing tests, it appears that the narrow definition of money is a better measure than the broad definition.

3. Estimation of the reserve flow equation (5.20) for the period 1955 to 1970 using the narrow definition of money and using current income.

The reason for introducing current income instead of permanent income rests mainly on the transactions motive for holding money balances. The growth rate of current income shows much greater variation than does the permanent income variable, and reflects the immediate change in income. The estimation of (5.20) using the current income variable, yielded the following results:

$$(5.25)^6 \quad \frac{R}{M1}\, g_R = \underset{(.22)}{.27}\, g_Y - \underset{(0.08)}{0.03}\, g_i + \underset{(0.43)}{0.78}\, g_p - \underset{(0.18)}{0.56}\, \frac{D_1}{M1}\, g_{D_1}$$

$R^2 = 0.48$

Durbin-Watson statistic = 1.87

The income variable is positive and appears with a coefficient of .27 and a standard error of .22, which implies that we have to reject the hypothesis of its being + 1.0 at the .05 significance level. Compared to the coefficient for permanent income obtained in equation (5.21), the current income variable is further away from its expected value. We recall from section 1 of this chapter that the permanent income coefficient was .64 with a standard error of .25, a result that is closer to that predicted by the monetary model than the result obtained by using current income. In the permanent income case we could not

reject the hypothesis that the coefficient was + 1.0, but we have to reject the same hypothesis for the current income coefficient. The interest rate variable has its expected negative sign, but it is not significantly different from zero at the .05 significance level. This result is similar to that obtained in equation (5.21). The price variable is high, compared to that obtained in the equation using permanent income. The price coefficient obtained in equation (5.25) was .78 and the standard error was .43. When we test the hypothesis that this coefficient is + 1.0, we find that we cannot reject it at a .05 significance level. The domestic credit variable turned out to be .6 with a standard error of .18. Testing the hypothesis of this coefficient's being - 1.0, we find that we have to reject this at a .05 significance level. This result is the same that was reached testing this coefficient for equation (5.21). The $R^2$ obtained in equation (5.25) is lower than that obtained for the equation using the permanent income variable. The Durbin-Watson statistic was 1.87, which falls into the inconclusive region at a .05 significance level, but in the acceptance region of no autocorrelation at the .01 significance level. Based on the estimation results, it seems that the current income definition yields results that are somewhat different from those obtained using permanent income, but none of them can definitely be said to support the monetary model. The support in both cases is rather weak.

4. Estimation of the reserve flow equation (5.20) for the period 1955 to 1965 using the narrow definition of money and permanent income.

The year 1965 signified a change in policital power as well as in organizational structure of the implementation of monetary policy in Norway. The change in political power was a result of the 1965 election

of representatives to the General Assembly, when for the first time during this period, the elected majority of representatives came from the nonsocialistic parties. These nonsocialistic parties then established a coalition and became the ones to form the new government. This change in political power turned out not to be of great importance since the new government chose to continue its policy in must the same manner as the former socialistic government.[7] It was expected that the new government would follow a more lenient interest rate policy, but instead it adopted the same low interest rate policy that the socialistic party had followed.[8] The new government stated its goal on this matter very clearly, and it proved that it regarded this goal as an important one by implementing policy measures to achieve the goal.[9] The other major change in 1965 was the introduction of "The Law Concerning the Authority to Regulate Monetary and Credit Conditions." This Act became law in 1965, but was not put to work until January 1966. The passing of this law signaled the end of the Joint Consultation Council and the "agreement" way of implementing monetary policy. The law gave wide discretionary power to the government, the policy instrument most heavily used by the ogvernment to control the liquidity turned out to be the reserve requirement. This policy instrument had been used little up to 1966.[10]

The above mentioned factors led to the expectation that there might have been a change in the regression line in 1965. Thus, a separate regression was estimated for the subperiod 1955 to 1965. The estimation of (5.20) for this period yielded the following result:

$$(5.26) \qquad \frac{R}{M1} g_R = \underset{(0.25)}{1.10}\, g_Y - \underset{(0.05)}{0.05}\, g_i - \underset{(0.49)}{0.92}\, g_p - \underset{(0.14)}{0.89}\, \frac{D_1}{M1} g_{D_1}$$

$R^2 = 0.88$

Durbin-Watson test = 2.25

The income variable entered with a coefficient of 1.10 and a standard error of .25; we, thus, cannot reject the hypothesis that this coefficient is + 1.0 at the .05 level of significance. Compared with the estimate of this coefficient for the period 1955 to 1970, the results in equation (5.26) are much closer to the expected value, but in both cases, the monetary hypothesis could not be rejected. The interest rate coefficient entered with its expected negative sign, compared to the estimate obtained for the whole period, this coefficient is larger and the standard error is smaller, but the variable is still not significantly different from zero at a .05 significance level. The price variable entered with a coefficient of - .92 and a standard error of .49; thus, we have to reject the hypothesis that this coefficient is + 1.0 at the .05 significance level. The opposite conclusion was reached for the 1955 to 1970 regression, but this result was mainly due to the presence of a large standard error of .46, the coefficient itself was .18. The domestic credit variable entered the regression with a coefficient of - .89 and a standard error of .14, which implies that we cannot reject the hypothesis that this coefficient is - 1.0. compared with the 1955 to 1970 regression, the subperiod had a coefficient that was closer to - 1.0 and it had a smaller standard error. The hypothesis for this domestic credit variable led to different conclusions in the two cases. The joint hypothesis

$$H_0 : a_1 = 1.0,\ a_2 = 1.0,\ a_4 = -1.0$$

against

$$H_1 : a_1 \neq 1.0,\ a_2 \neq 1.0,\ a_4 \neq -1.0$$

was tested and the resulting F value was 29.6, which implies that we have to reject the null hypothesis at the .05 level of significance. The same conclusion was reached when testing this joint hypothesis for the whole time period 1955 to 1970. A comparison of the $R^2$'s for the two regressions (5.21) and (5.26) shows an increase in this measure from .63 to .88, when estimating the shorter period. The Durbin-Watson statistic obtained was 2.25, which implies nonrejection of the hypothesis of no autocorrelation.

It is of interest to know if the time period 1955 to 1970 should be treated as two samples or if it is justified to pool the data and run only one regression for the whole time period. The test used for this purpose is the Chow test, which is a test for stability of the coefficients. It is descirbed in G. S. Maddala, Econometrics, (20, 1977. pp. 198-200). The null hypothesis to be tested is

$$H_0 : a_1^{(31)} = a_1^{(35)},\ a_2^{(31)} = a_2^{(35)},\ a_3^{(31)} = a_3^{(35)},\ a_4^{(31)} = a_4^{(35)}$$

against

$$H_1 : a_1^{(31)} \neq a_1^{(35)},\ a_2^{(31)} \neq a_2^{(35)},\ a_3^{(31)} \neq a_3^{(35)},\ a_4^{(31)} \neq a_4^{(35)}.$$

The following F test applies:

$$F = \frac{(RRSS - URSS)/(k)}{URSS/(n_1 + n_2 - 2k)}$$

which has an F distribution with k, $n_1 + n_2 - 2k$ degrees of freedom. URSS is, as before, the unrestricted sum of squares, it is obtained by estimating two separates regressions, one for the subperiod 1955 to 1965, and one for 1965 to 1970. The residual sum of squares for each equation then are added together to get URSS. RRSS, which is the restricted residual sum of squares, is obtained by running the regression for the total period 1955 to 1970. In this case the following results were obtained:

$URSS_{1955\text{-}1965} = .00242$

$URSS_{1965\text{-}1970} = .00256$

$RRSS_{1955\text{-}1970} = .01036$

$k$ = the number of parameters, here 4

$n_1$ = number of observations in subperiod 1, here 10

$n_2$ = number of observations in subperiod 2, here 5

The calculated F value using these figures is 1.89, which falls into the acceptance region at the .10 level of significance since $F_{4,7} = 4.12$. On this basis, we cannot reject the hypothesis that the relationship is stable and we can pool the data and estimate only one equation.

5. Estimation of the reserve flow equation (5.20) for the period 1955 to 1965 using the broad definition of money and using permanent income.

The background for estimating this equation is the same as for estimating the corresponding equation using the narrow definition of money, and will consequently not be repeated here. The following results were obtained:

$$(5.27)^{11} \quad \frac{R}{M2}\, g_R = \underset{(.04)}{-.0008}\, g_i + \underset{(.32)}{1.09}\, g_Y - \underset{(.38)}{.58}\, g_p - .97\, \frac{D_2}{M2}\, g_{D_2}$$

$R^2 = .67$

Durbin-Watson test = 2.00

The interest rate variable is negative and not significantly different from zero at the .05 level, the income variable enters with a coefficient of 1.1 and a standard error of .32. We, thus, cannot reject

the hypothesis that this coefficient is + 1.0 at the .05 significance level. If we compare this result with the coefficient obtained in the corresponding 1955 to 1970 regression, equation (5.24), we find that the latter equation obtained a much lower coefficient for the income variable, which entered with a coefficient of .40. The coefficient is, on the other hand, very similar to the income coefficient obtained for the subperiod using the narrow definition of money, equation (5.26). The price variable entered with a coefficient of - .58 and a standard error of .38 and just as in the 1955 to 1970 regression, we have to reject the hypothesis that this coefficient is + 1.0 at the .05 significance level. The same conclusion was reached for the 1955 to 1970 regression using the narrow definition of money. The domestic credit variable obtained a coefficient of - .97 and a standard error of .29. Thus, we cannot reject the hypothesis of this coefficient's being - 1.0 at the .05 level of significance. This conclusion is the opposite of that reached for the regression covering the whole period. But, again, it is very similar to the result for the narrow definition of money regression for this period. The $R^2$ for this regression was higher than the $R^2$ obtained for the whole period. Although the increase was from .32 to .67, it is still lower than the $R^2$'s obtained for the corresponding regressions using the narrow definition of money.

Single Equation Estimates with Special Attention to the Shipping Sector

The purpose of this section is to see if the capital movements associated with a large specific sector within the country will have any influence on the reserve flow equation. To test this the shipping sector was chosen for two reasons: (1) this sector is not much dependent

upon the specific Norwegian credit conditions in obtaining the necessary capital.[12] (2) Variations in international reserves are heavily influenced by the movements in the net foreign capital transactions of this sector. To illustrate this influence, we can look at the net foreign capital transactions for the shipping sector for the period 1955 to 1970.

The net capital position is defined as: Direct foreign loans plus Commercial loans for shipping purchases minus Repayments on shipping loans minus Change in prepayments on ships. Data for calculating these variable were taken from Statistisk Aarbok (22).

Shipping Capital Transactions
(in millions of kroner)

| | | | |
|---|---|---|---|
| 1955 - 542 | 1959 - 859 | 1963 - 1098 | 1967 - 1539 |
| 1956 - 321 | 1960 - 77 | 1964 - 344 | 1968 - 249 |
| 1957 - 170 | 1961 - 1182 | 1965 - 849 | 1969 - 214 |
| 1958 - 709 | 1962 - 515 | 1966 - 778 | 1970 - 969 |

To get a better idea of the relative size of the above numbers, we can take a look at the size of net foreign reserves for the same time period. Data for this variable are taken from International Financial Statistics (17).

Foreign Assets (net)
(in millions of kroner)

| | | | |
|---|---|---|---|
| 1955 - 250 | 1959 - 2080 | 1963 - 1930 | 1967 - 4570 |
| 1956 - 800 | 1960 - 2220 | 1964 - 2200 | 1968 - 5590 |
| 1957 - 1000 | 1961 - 1710 | 1965 - 3330 | 1969 - 5210 |
| 1958 - 1290 | 1962 - 1540 | 1966 - 3400 | 1970 - 6380 |

The monetary approach to the balance of payments predicts that there will be no change in the reserve flow as long as the shipping sector activities do not influence the domestic demand for money. This result follows because offsetting actions in the economy will always take place, and the use or distribution of the reserve flow will be of no importance. To test if this is so, even for such a large sector as the shipping sector for the case of Norway, a new independent variable was defined as the growth rate of the net capital position for the shipping sector. The model to be estimated will then be:

$$(5.28) \qquad \frac{R}{M_i} g_R = a_1 g_Y + a_2 g_i + a_3 g_p + a_4 g_s + a_5 \frac{D_i}{M_i} g_{D_i}$$

where:

$g_s$ = the growth rate of shipping capital transactions and the rest of the variables are as defined earlier.

This model was estimated for the time period 1955 to 1970, and the following estimates were obtained, using the narrow definition of money and using permanent income:

$$(5.29)^{13} \qquad \frac{R}{M1} g_R = 0.61\ g_Y - 0.09\ g_i + 0.26\ g_p - 0.002\ g_s - 0.62\ \frac{D_1}{M1} g_{D_1}$$

$R^2 = 0.65$

Durbin-Watson statistic = 2.06

The income variable coefficient is .61 and it has a standard error of .26. The hypothesis that this coefficient is + 1.0 cannot be rejected at the 0.05 significance level. This result is very similar to that obtained for the corresponding equation omitting the shipping variable, equation (5.21). The interest rate coefficient is not significantly different from zero, but it has its expected negative sign. The price

variable enters with a coefficient of .26 and a standard error of .48. Thus, we cannot reject the hypothesis that this coefficient is + 1.0 at the .05 significance level. Compared with the result obtained for this variable in equation (5.21), the corresponding basic equation, we note that the the coefficient here is somewhat higher, but both have very large standard errors. The variable of most interest in this equation is the shipping variable, which has a coefficient of .002 and a standard error of .002. Thus, it is not significantly different from zero at the .05 level. The domestic credit variable is not significantly different from - 1.0 at the .05 significance level since the obtained coefficient is - .062 and the standard error is .16. Compared with the coefficient for this variable obtained for the corresponding basic equation, (5.21) we note that the latter got a somewhat higher coefficient of .65 and the same standard error of .16.

Looking at the $R^2$'s, we see a slight improvement in $R^2$ from .63 to .65, but this is a trivial result as the $R^2$ will either increase or remain the same with the inclusion of an additional variable. The Durbin-Watson statistic tells us that we cannot reject the hypothesis of no autocorrelation. Based on the fact that the shipping variable was not significantly different from zero, we can conclude that this variable has no effect on the reserve flow and should probably be excluded from the estimated equation. This result supports the monetary approach. Equation (5.28) was also estimated for the same time period using the broad definition of money and using permanent income. The results of this estimation was:

$$(5.30)^{14} \quad \frac{R}{M2} g_R = \underset{(0.05)}{0.02}\, g_i + \underset{(0.20)}{0.37}\, g_Y + \underset{(0.28)}{0.27}\, g_p - \underset{(0.002)}{0.002}\, g_s - \underset{(0.19)}{0.37}\, \frac{D_2}{M2} g_{D_2}$$

$R^2 = 0.41$

Durbin-Watson statistic = 2.20

The interest rate variable is not significantly different from zero at the .05 level. Moreover, the sign of the coefficient is opposite that expected, a result in line with that obtained in equation (5.24), the corresponding basic reserve flow equation. The income variable enters the equation with a coefficient of .37 and a standard error of .20, which implies that we have to reject the hypothesis of this coefficient's being + 1.0 at the .05 level. The price variable is positive, but we have to reject the hypothesis of the coefficient's being + 1.0; again a result similar to that obtained in equation (5.24). The shipping variable is not significantly different from zero at the .05 level of significance. It enters with a coefficient of .002 and a standard error of .002. The coefficient of the domestic credit variable was a low - .37 and a standard error of .19, which leads to rejection of the hypothesis that this coefficient is - 1.0. In the corresponding equation (5.24), the coefficient for this variable was larger in absolute value, but the hypothesis had to be rejected in that case, too. The Durbin-Watson statistic of 2.20 implies nonrejection of the hypothesis of no autocorrelation. Based on the above, the shipping variable does not seem to add anything to the reserve flow equation, and should be excluded from the model. This result is in line with the expectations of the monetary model.

Single Equation Estimates: Explicitly Introducing World Relations

As outlined in the theoretical part, world monetary equilibrium can be incorporated in the reserve flow model. The purpose of expanding the model in this way is to get a better idea of the forces that determine the exogenously given prices and interest rates in the basic monetary model. The simplifying, but perhaps not too realistic, assumption of no growth in reserves world wide was retained during the empirical testing of the model. Two different measures of world credit creation will be tested. The first is a weighted average of the credit creation in nine major trade partners of Norway; the weights being the share of trade by that country. The other measure is an unwieghted average of the same variable. The relationship to be estimated is then:

$$(5.31)\quad \frac{R(z)}{M_{i(z)}} g_{R(z)} = a_2 g_{Y(z)} - b_2 g_{Y(f)} + a_4 \frac{D_{i(f)}}{M_{i(f)}} g_{D_{i(f)}} + a_5 \frac{D_{i(z)}}{M_{i(z)}} g_{D_{i(z)}} + a_6 g_{i(z)}$$

where:

$z$ = the home country

$f$ = the rest of the world

$g_{Y(f)}$ = permanent income growth in the rest of the world

$g_{D_{i(f)}}$ = growth in domestic credit in the rest of the world

$g_{Y(z)}$ = growth in permanent income in the home country

$g_{D_{i(z)}}$ = growth in domestic credit in the home country

$g_{i(z)}$ = growth in the domestic interest rate

The exact definition of permanent income growth in the rest of the world is:

$$(5.32)\quad g_{Y(f)} = ((DGNP * 8.4) + (SGNP * 24.0) + (GBGNP * 19.6) + (WGGNP * 20.8) + (USGNP * 8.6) + (CGNP * 4.6) + (FGNP * 3.9) + (IGNP * 2.8) + (HGNP * 4.2) + (FIGNP * 3.1))/100$$

where:

DGNP = permanent income growth in Denmark

SGNP = permanent income growth in Sweden

GBGNP = permanent income growth in United Kingdom

WGGNP = permanent income growth in West Germany

USGNP = permanent income growth in the United States

CGNP = permanent income growth in Canada

FGNP = permanent income growth in France

IGNP = permanent income growth in Italy

HGNP = permanent income growth in the Netherlands

FIGNP = permanent income growth in Finland

The foreign credit variables are constructed in a similar manner, using data from the nine major trade partners. The reason for excluding Italy from the construction of this variable is the absence of comparable data.

The first measure used is a weighted average of these nine countries' domestic credit growth rates, calculated as:

$$(5.33)\quad \frac{D_{1(f)}}{M1(f)}\, g_{D_{1(f)}} = ((DDC1 * 8.6) + (SDCL * 24.7) + (GBDC1 * 20.2) + (WGDC1 * 21.4) + (USDC1 * 8.9) + (CDC1 * 4.7) + (FDC1 * 4.0) + (HDC1 * 4.3) + (FIDC1 * 3.2)/100$$

The second definition of the foreign credit variable is an unweighted average of these countries' credit growth rates, or more precisely expressed:

$$(5.34) \quad \frac{D_{i(f)}}{M1(f)}\, g_{D_1(f)} = (DDC1 + SDC1 + GBDC1 + WGDC1 + USDC1 + CDC1 + FDC1 + HDC1 + FIDC1)/9$$

For both of these foreign credit definitions, the definitions of the arguments are:

$$DDC1 = \frac{D_1(D)}{M1(D)}\, g_{D_1(D)}, \quad D = \text{Denmark}$$

$$SDC1 = \frac{D_1(S)}{M1(S)}\, g_{D_1(S)}, \quad S = \text{Sweden}$$

$$GBDC1 = \frac{D_1(GB)}{M1(GB)}\, g_{D_1(GB)}, \quad GB = \text{The United Kingdom}$$

$$WGDCL = \frac{D_1(WG)}{M1(WG)}\, g_{D_1(WG)}, \quad WG = \text{West Germany}$$

$$USDC1 = \frac{D_1(US)}{M1(US)}\, g_{D_1(US)}, \quad US = \text{the United States}$$

$$CDC1 = \frac{D_1(C)}{M1(C)}\, g_{D_1(C)}, \quad C = \text{Canada}$$

$$FDC1 = \frac{D_1(F)}{M1(F)}\, g_{D_1(F)}, \quad F = \text{France}$$

$$HDC1 = \frac{D_1(H)}{M1(H)}\, g_{D_1(H)}, \quad H = \text{The Netherlands}$$

$$FIDC1 = \frac{D_1(FI)}{M1(FI)}\, g_{D_1(FI)}, \quad FI = \text{Finland}$$

Both of these definitions build on the narrow definition of money. Equation (5.31) was then estimated for the time period 1955 to 1970, using the definition fo foreign credit defined in equation (5.33). The estimation yielded the following results;

(5.35)[15] $\frac{R(z)}{M1(z)}\ g_{R(z)} = \underset{(0.098)}{0.026}\ g_i + \underset{(0.80)}{1.24}\ g_{Y(z)} - \underset{(0.78)}{0.39}\ g_{Y(f)}$

$$- \underset{(0.40)}{0.11}\ \frac{D_1(f)}{M1(f)}\ g_{D_1(f)} - \underset{(0.17)}{0.70}\ \frac{D_1(z)}{M1(z)}\ g_{D_1(z)}$$

$R^2 = 0.64$

Durbin-Watson test = 2.15

The interest rate variable enters with its expected negative sign, but it is not significantly different from zero at the .05 level. The coefficient for the permanent income variable for the home country is fairly close to its expected value of + 1.0, and we cannot reject the hypothesis of its being + 1.0. We should, however, also note the high standard error on this variable of .80. The foreign income variable, $g_{Y(f)}$, enters with a negative coefficient as expected. This variable obtains a coefficient of - .39 and a standard error of .78. On this basis, we cannot reject the hypothesis of its coefficient being - 1.0 at the .05 significance level. The foreign credit variable is negative with a coefficient of - .11 and a standard error of .40 and we have to reject the hypothesis that this coefficient is + 1.0 at the .05 level. The domestic credit variable is negative and we cannot reject the hypothesis that it is - 1.0 at the .05 level of significance. The variables $g_{Y(f)}$, $\frac{D_i(f)}{Mi(f)}\ g_{D_{i(f)}}$ and $g_{i(z)}$ are linked to $g_{p(z)}$ by the relationship (5.18) or:

(5.37) $$g_{p(z)} = - b_2 g_{Y(f)} + \frac{D_i(f)}{Mi(f)}\ g_{D_{i(f)}} - g_{i(z)}$$

Thus, we can compare the explanatory power of equations (5.21) and (5.35). We find that in terms of $R^2$ they obtain close to the same value. As a

conclusion, it seems as if the growth in foreign income and the growth in foreign credit is a good measure for the growth in domestic prices. Equation (5.31) was also estimated for the time period 1955 to 1970 using the definition of foreign credit defined in equation (5.34), that is the unweighted measure. The estimation of this relationship gave the following results:

$$(5.36)^{16} \quad \frac{R(z)}{M1(z)} g_{R(z)} = \underset{(.07)}{-.06}\, g_i + \underset{(.74)}{1.64}\, g_{Y(z)} \underset{(.66)}{-.44}\, g_{Y(f)} \underset{(.27)}{-.44} \frac{D_1(f)}{M1(f)} g_{D_1(f)} \underset{(.16)}{-.79} \frac{D_1(z)}{M1(z)} g_{D_1(z)}$$

$R^2 = .72$

Durbin-Watson test = 2.07

The interest rate variable has its expected negative sign and is not significantly different from zero at the .05 significance level. Compared to equation (5.35), i.e., the regression using the weighted average foreign credit variable, the coefficient is larger in absolute value. The domestic income variable is positive and we cannot reject the hypothesis that it equals its expected value of + 1.0 at the .05 level of significance. Compared with equation (5.35), the coefficient is further away from its expected value, 1.64 as compared to 1.24, but both estimates resulted in nonrejection of the null hypothesis. The foreign credit variable is negative and further away from its expected value than in equation (5.35). In any event, we have to reject the hypothesis of its being equal to + 1.0 in both cases. The domestic credit variable enters with a coefficient of - .79 and a standard error of .16, which indicates that we cannot reject the hypothesis of its being - 1.0 at the

.05 level of significance. Compared with equation (5.35) this result is closer to the expected value for this coefficient, but the null hypothesis had to be accepted in both cases. Since both domestic price inflation and domestic interest rate development are exogenously determined, they can both be expressed as a function of foreign income growth and foreign credit creation:

$$(5.38) \qquad g_{p(z)} + b_3 g_{i(z)} = - b_2 g_{Y(f)} + \frac{D_i(f)}{Mi(f)} g_{D_i(f)}.$$

Substituting this into the reserve flow equation yields the following relationship:

$$(5.39) \qquad \frac{R(z)}{Mi(z)} g_{R(z)} = a_2 g_{Y(z)} - b_2 g_{Y(f)} + \frac{D_i(f)}{Mi(f)} g_{D_i(f)} + a_4 \frac{D_i(z)}{Mi(z)} g_{D_i(z)}.$$

This equation was estimated for the period 1955 to 1970 using definition (5.33) for foreign credit with the following result:

$$(5.40)^{17} \quad \frac{R(z)}{M1(z)} g_{R(z)} = \underset{(0.76)}{1.21} g_{Y(z)} - \underset{(.72)}{.45} g_{Y(f)} - \underset{(0.30)}{0.04} \frac{D_1(f)}{M1(f)} g_{D_1(f)} - 0.68 \frac{D_1(z)}{M1(z)} g_{D_1(z)}$$

$R^2 = 0.64$

Durbin-Watson test = 2.03

This result is similar to that obtained for equation (5.35). The coefficients are of about the same magnitude and the same can be said about the standard errors. The coefficient that changed the most was the foreign credit variable, which decreased in absolute value from 0.11 to 0.04, but it is still negative and based on a standard error of 0.30, we have to reject the hypothesis that this coefficient is + 1.0 at the

.05 significance level. The $R^2$ is equal to the $R^2$ obtained in equation (5.35). From the above estimations, it seems that the exogenously determined domestic price growth and domestic interest rate growth, can be successfully substituted for the world income growth and the world credit growth.

On the theoretical expectation of the home and foreign income variables having the same coefficient in absolute value, the coefficient is restricted to be the same. This is done by estimating the following model:

$$(5.41) \quad \frac{R(z)}{Mi(z)} g_{R(z)} = a(g_{Y(f)} - g_{Y(f)}) + \frac{D_i(f)}{Mi(f)} g_{D_i(f)} + a_4 \frac{D_i(z)}{Mi(z)} g_{D_i(z)} + a_5 g_{i(z)}$$

Estimation for the time period 1955 to 1970 yielded the following results:

$$(5.42)^{18} \quad \frac{R(z)}{Ml(z)} g_{R(z)} = \underset{(0.85)}{-.72} (g_{Y(f)} - g_{Y(z)}) \underset{(0.08)}{- 0.11} g_{i(z)} + \underset{(0.15)}{0.65} \frac{D_l(f)}{Ml(f)} g_{D_l(f)} \underset{(0.17)}{- 0.51} \frac{D_l(z)}{Ml(z)} g_{D_l(z)}$$

$R^2 = 0.50$

Durbin-Watson test = 1.31

The income variable's coefficient was - .72 with a standard error of .85. Thus, we cannot reject the hypothesis that foreign income is - 1.0 or that domestic income is + 1.0 at the .05 significance level. The interest rate variable enters with its expected negative sign, but it is not significantly different from zero at the .05 level. The foreign credit variable enters with a positive sign. Since its coefficient is + .65 and its standard error is .15, we have to reject the hypothesis

that this coefficient is + 1.0. The domestic credit variable is negative as expected, but the hypothesis of its being - 1.0 must be rejected at a significance level of .05.

The monetary model incorporating world relations was also estimated using the alternative variable for foreign credit growth, that is, the unweighted average instead of the weighted average. Using definition (5.34) of domestic credit yielded the following estimates of the reserve flow equation for the period 1955 to 1970:

$$(5.43)^{19}\quad \frac{R(z)}{M1(z)}\ g_{R(z)} = \underset{(.73)}{1.57}\ g_{Y(z)} - \underset{(.65)}{.51}\ g_{Y(f)} - \underset{(.24)}{.35}\ \frac{D_1(f)}{M1(f)}\ g_{D_1(f)} + .74\ \frac{D_1(z)}{M1(z)}\ g_{D_1(z)}$$

$R^2 = .70$

Durbin-Watson test = 2.00

The domestic income variable is not significantly different from 1.0, the foreign income variable is negative as predicted by the monetary model and has a coefficient of - .51 with a standard error of .65; thus, we cannot reject the hypothesis of this coefficient's being - 1.0. The foreign credit variable enters with a negative sign, as compared with its expected value of + 1.0. The domestic credit variable enters with a coefficient of .74 and a standard error of .14, which implies that the hypothesis of this coefficient's being - 1.0 cannot be rejected. All of the above tests were conducted at the .05 level of significance. This result is similar to that obtained using the weighted average measure of foreign credit, the only coefficient that differs to any extent is that of the foreign credit variable, which changed from - .04 to - .35. Thus, it moved further away from its expected

value. Equation (5.31) was also estimated for the subperiod 1955 to 1965, yielding the following result:

$$(5.44)^{20}\quad \frac{R(z)}{M1(z)}\, g_{R(z)} = \underset{(0.10)}{-\ 0.05}\, g_{i(z)} + \underset{(.90)}{.70}\, g_{Y(z)} - \underset{(.75)}{.10}\, g_{Y(f)} + \underset{(0.49)}{0.08}\, \frac{D_1(f)}{M1(f)}\, g_{D_1(f)} - \underset{(0.19)}{0.83}\, \frac{D_1(z)}{M1(z)}\, g_{D_1(z)}$$

$R^2 = 0.81$

Durbin-Watson test = 1.78

The domestic income growth enters with a coefficient of .70 and a standard error of .90. Based on this, we cannot reject the hypothesis that this coefficient is + 1.0 at the .05 significance level. The foreign income coefficient is now negative as expected, but its value is low in absolute value - .10 as compared to the expected value of - 1.0. In spite of the high standard error, the hypothesis of the coefficient's reaching its expected value, has to be rejected at the .05 level of significance. The foreign credit variable enters with a positive sign and we cannot reject the hypothesis of its being + 1.0 at the .05 significance level. We also have to accept the hypothesis that the domestic credit variable reached its expected value. In terms of explanatory power, equation (5.44) can be compared with equation (5.26). We find that the latter equation obtained a somewhat larger $R^2$, but the increase was only from .81 to .88. Thus, it seems like the foreign income variable and the foreign credit variable is a good measure for the domestic price level. This is the same conclusion that was reached for the total period estimation of the same relationship.

Single Equation Estimates: Introducing the World Price Level

The Monetary Model builds on the assumption that the integrated market hypothesis holds, that is, that the development of the Norwegian price level is determined by the development of the World price level. This hypothesis was tested for the case of Norway for the time period 1955 to 1970, and we found that we could not reject it. On this background, it should not make any difference if we use the Norwegian or the World price level as an independent variable in the reserve flow equation. To see if this holds true, the reserve flow equation was estimated using the world inflation rate instead of the Norwegian inflation rate. The estimated equation is then:

$$(5.45) \qquad \frac{R}{M1} g_R = a_1 g_Y + a_2 g_i + a_3 g_{WINF} + a_4 \frac{D_i}{M1} g_{D_i}$$

where:

WINF = world inflation, defined as in equation (5.32)

the rest of the variables are as defined earlier.

The expected signs and magnitudes of the coefficients are the same as for the standard reserve flow equation, which implies that the expected value for $a_3$ is + 1.0. Equation (5.45) was estimated for the period 1955 to 1970 using the narrow definition of money and using permanent income. The estimation yielded the following result:

$$(5.46)^{21} \qquad \frac{R}{M1} g_R = \underset{(0.09)}{0.0004}\, g_i + \underset{(0.48)}{.87}\, g_Y - \underset{(1.13)}{0.35}\, g_{WINF} - \underset{(0.16)}{0.66} \frac{D_1}{M1} g_{D_1}$$

$R^2 = 0.63$

Durbin-Watson test = 1.88

The interest rate variable enters with a negative sign, but the coefficient is not significantly different from zero at the .05

significance level. The income variable enters with its expected sign and we cannot reject the hypothesis that this coefficient is + 1.0 at the .05 significance level. The World inflation variable is negative and has a standard error of 1.13, the expected value of this coefficient is + 1.0, and the hypothesis of its reaching its expected value cannot be rejected because of the large standard error. The domestic credit variable enters with - .66 and a standard error of .16. Thus, we cannot reject the hypothesis of this coefficient's being - 1.0. Compared with the estimation results obtained using the Norwegian price level, equation (5.21), we find that the results are similar. The largest difference occurred in the price variable, which switched from a positive .18 to a negative - .35. The standard error, however, was large in both cases, and led to nonrejection of the null hypothesis. The interest rate variable also changed sign, but in both cases this variable turned out to be insignificant. The $R^2$'s are of equal size.

Equation (5.44) was also estimated for the subperiod 1955 to 1965 with the following results:

$$(5.47)^{22} \quad \frac{R}{M1} g_R = \underset{(0.07)}{-\ 0.02}\ g_i + \underset{(0.41)}{1.12}\ g_Y - \underset{(.98)}{1.14}\ g_{WINF} - \underset{(0.16)}{0.84}\ \frac{D_1}{M1}\ g_{D_1}$$

$R^2 = 0.84$

Durbin-Watson test = 2.33

The interest rate variable enters with its expected negative sign, but is not significantly different from zero. The income variable is positive as expected and we cannot reject the hypothesis that this coefficient is + 1.0. The world inflation variable enters with a negative sign of - 1.14 and a standard error of .98, in contrast to its expected value of + 1.0. The domestic credit variable is negative and we cannot reject the

hypothesis that this coefficient is - 1.0 at the .05 significance level. If we compare equation (5.47) with the results obtained in equation (5.26) we find that they are very similar as expected. The price variable in equation (5.26) is smaller in absolute value than the price coefficient in equation (5.47), but they both have large standard errors leading to rejection of the null hypothesis. The $R^2$ obtained in equation (5.26) is somewhat larger than the $R^2$ obtained in equation (5.47), .88 as compared with .84.

Based on the foregoing estimations, as well as on the separate testing of the integrated market hypothesis, it seems that the world price inflation is a good measure of the domestic price inflation.

Single Equation Model: Testing for Possible Effects of the 1967 Devaluations by Some of Norway's Major Trade Partners

Norway did not devalue or revalue its currency at any time during the time period 1955 to 1970. But in 1967 several of Norway's major trade partners devalued their currencies, this section is aimed at finding out if these devaluations had any effect on the Norwegian reserve flow. To examine this question, several models were estimated and will be discussed in the following. The expected sign of the dummy variable representing the devaluation is negative, that is, since Norway did not devalue, the devaluation by the other countries would lead to an outflow of reserves.

1. Single equation model with a time dummy variable for the year 1967-1968.

The devaluations by Norway's major trade partners all took place in the last part of the year 1967, more specifically in November and December. Thus, introducing a time dummy variable for 1967 assumes

an immediate effect of the devaluation. The model to be estimated will then be:

$$(5.48) \quad \frac{R}{M1} g_R = a_1 g_i + a_2 g_Y + a_3 g_p + a_4 T + a_5 \frac{D_1}{M1} g_{D_1} + u$$

where:

T = 1, if the year is 1967-68

T = 0, if the year is not 1967-68

u = stochastic disturbance term

all other symbols were defined earlier.

Equation (5.48) was estimated for the period 1955 to 1970 using the narrow definition of money and using permanent income. The estimation yielded the following results:

$$(5.49)^{23} \quad \frac{R}{M1} g_R = \underset{(0.07)}{-0.03}\, g_i + \underset{(0.40)}{0.30}\, g_p + \underset{(0.23)}{0.55}\, g_Y - \underset{(0.15)}{0.70} \frac{D_1}{M1} g_{D_1} + \underset{(0.03)}{0.06} T$$

$R^2 = 0.75$

Durbin-Watson test = 1.66

We note that the coefficient for the income variable, $g_Y$, is .55 with standard error of .23. The prediction of the monetary model is that this coefficient is + 1.0. Testing the hypothesis:

$H_0 : a_2 = +1.0$

against

$H_1 : a_2 \neq +1.0$

revealed that the null hypothesis cannot be rejected at the .05 significance level. The coefficient for the interest rate variable is not significantly different from zero, but it has its expected negative sign. The price variable is positive with a coefficient of .30 and a standard error of .40. The monetary model predicts that this

coefficient will be + 1.0. This hypothesis cannot be rejected at the .05 level. This result is still not too supportive of the monetary model because of the big standard error. The domestic credit variable, which is expected to be - 1.0, turned out to be - .7 with a standard error of .13; thus, we cannot reject the hypothesis of its being equal to - 1.0 at a significance level of .05. The $R^2$ obtained from this equation was a fairly high .75.

It is also of interest to test the hypothesis that the coefficients for income, price and domestic credit all obtain their hypothesized values simultaneously. The relevant null hypothesis would be:

$$H_0 : a_2 = +1.0,\ a_3 = +1.0,\ a_5 = -1.0$$

against

$$H_1 : a_2 \neq +1.0,\ a_3 \neq +1.0,\ a_5 \neq -1.0$$

To carry out this test, we need to run an additional regression in which we restrict the above mentioned parameters to their predicted values. The following statistic will then have an F distribution:

$$\frac{(RRSS - URSS)/3}{(URSS/n-k-1)} = F_{3,n-k-1}$$

where:

URSS = unrestricted residual sum of squares

RRSS = restricted residual sum of squares

n = number of observations

k = number of parameters estimated

In this case we have:

URSS = .0072

RRSS = .0595

n-k-1 = 9

The calculated F value is then 22.4, which falls in the rejection region at the .10 level of significance. On this basis, we have to reject the hypothesis that the three coefficients have their expected values. It is of further interest to compare the results obtained in equation (5.49) with the results obtained in equation (5.21), i.e., the same equation excluding the time dummy variable. The income variable is somewhat lower in the equation including the 1967-68 time dummy variable, but as we saw earlier, the hypothesis of this coefficient's being equal to + 1.0 cannot be rejected in either case. The interest rate variable is significant in both equations. The price variable increased in the dummy variable equation from .18 to .30, but the large standard errors obtained in both cases make this coefficient unreliable. The domestic credit variable had approximately the same effect in the two regressions, with a slight increase in the coefficient and a decrease in the standard error for the dummy variable regression. The dummy variable, T, itself entered the regression with a coefficient of .06 and a standard error of .03; thus, it is not significantly different from zero at the .05 significance level, but it is close to being so. It enters, however, with a positive sign in contrast to the predicted negative sign. We can also compare the explanatory power of the two regressions as it is represented by the values of $R^2$. The value of $R^2$ increased from .63 to .75 by adding the time dummy variable. The effects of adding the time dummy variable, T, to the reserve flow equation did not turn out quite according to the expectations, because the sign of the time variable's coefficient was opposite that expected. Moreover, the coefficient was not significant at the .05 level.

2. Single equation model with a time dummy variable for the year 1968-69.

While the foregoing model assumed that the effects of the devaluation by the major trade partners was immediate, this model assumes that there is a lag before the effects will be noted on the Norwegian economy. The model will then be:

$$(5.50) \qquad \frac{R}{M1} g_R = a_1 g_i + a_2 g_Y + a_3 g_p + a_4 T_3 + a_5 \frac{D_1}{M1} g_{D_1} + u'$$

where:

$T_3 = 1$, if the year is 1968-69

$T_3 = 0$, if the year is not 1968-69

$u'$ = stochastic error term

The estimation of equation (5.50) for the period 1955 to 1970, using the narrow definition of money and using permanent income, yielded the following results:

$$(5.51)^{24} \qquad \frac{R}{M1} g_R = \underset{(0.27)}{.68\, g_Y} - \underset{(0.008)}{0.02\, g_i} + \underset{(0.49)}{0.94\, g_p} - \underset{(0.04)}{0.02\, T_3} - \underset{(0.17)}{0.62} \frac{D_1}{M1} g_{D_1}$$

$R^2 = 0.64$

$\bar{R}^2 = 0.49413$

Durbin-Watson test = 1.54

The income variable enters with a coefficient of .68 and a standard error of .27, which implies that we cannot reject the hypothesis that this coefficient is + 1.0 at the .05 significance level. The interest rate is negative and not significantly different from zero. The price variable has its expected sign and is close to its expected value of + 1.0. We cannot reject the hypothesis of the income coefficient's being + 1.0, at the .05 level. The time dummy variable has its expected

negative sign, but it is not significantly different from zero at the .05 level since its coefficient is .02 and its standard error is .04. The domestic credit variable is negative and we cannot reject the hypothesis of it being equal to - 1.0 at the .05 level. The Durbin-Watson test tells us that the result of testing for no autocorrelation is inconclusive both at the .05 and the .01 level of significance.

3. Single equation model with a time dummy variable for the years 1967 to 1969.

The two foregoing models both assumed that the effects of the devaluations lasted for one year only. This, however, may not be the case, therefore, we introduce a dummy variable covering the two following years. The model is now:

$$(5.52) \qquad \frac{R}{M1} g_R = a_1 g_i + a_2 g_Y + a_3 g_p + a_4 T_1 + a_5 \frac{D_1}{M1} g_{D_1} + e$$

where:

$T_1$ = 1, if the year is 1967 or 1968

$T_1$ = 0, if the year is not 1967 or 1968

e = stochastic error term

Equation (5.52) was estimated for the period 1955 to 1970 using the narrow definition of money and using permanent income. The results of the estimation were:

$$(5.53)^{25} \qquad \frac{R}{M1} g_R = \underset{(0.08)}{-\ 0.04}\ g_i + \underset{(0.27)}{0.54}\ g_Y + \underset{(0.48)}{0.34}\ g_p + \underset{(0.03)}{0.03}\ T_1 - \underset{(0.16)}{0.72}\ \frac{D_1}{M1} g_{D_1}$$

$R^2 = 0.67$

Durbin-Watson test = 2.20

The interest rate variable is negative as expected, but it is not significantly different from zero at the .05 level. The income variable

enters with the expected sign, and we cannot reject the hypothesis that this coefficient is + 1.0. The price variable has its expected positive sign, but the coefficient is a rather low .34. It does, however, have a large standard error of .48, and we consequently cannot reject the hypothesis that it obtains its expected value of + 1.0 at the .05 level of significance. The time dummy variable, $T_1$, has a positive sign as opposed to its expected negative sign. In addition, the coefficient is not significantly different from zero at the .05 level of significance. The domestic credit variable enters with a coefficient of - .72 and a standard error of .16. Based on this, we cannot reject the hypothesis that this coefficient is - 1.0 at the .05 significance level. Based on the lack of statistical significance, as well as the opposite sign of the time dummy variable, $T_1$, it appears that this variable should not be included in the model. The Durbin-Watson test implies that we cannot reject the hypothesis of no autocorrelation at the .05 level of significance.

4. Single equation model with two time dummy variables.

The idea behind the introduction of two separate variables instead of one combined variable as in part 3, is to see if the two years had an opposite effect on the reserve flow equation. The new model to be estimated is then:

$$(5.54) \qquad \frac{R}{M1} g_R = a_1 g_i + a_2 g_Y + a_3 g_p + a_4 T + a_5 T_3 + a_6 \frac{D_1}{M1} g_{D_1} + e'$$

where:

T = 1, if the year is 1967

T = 0, if the year is not 1967

$T_3$ = 1, if the year is 1968

$T_3$ = 0, if the year is not 1968

e' = stochastic error term

Equation (5.54) was estimated for the period 1955 to 1970 using the narrow definition of money and using permanent income. The estimation yielded the following results:

$$(5.55)^{26} \quad \frac{R}{M1} g_R = \underset{(0.07)}{-0.03}\, g_i + \underset{(0.25)}{0.57}\, g_Y + \underset{(0.45)}{0.26}\, g_p + \underset{(0.03)}{0.06}\, T - \underset{(0.03)}{0.008}\, T_3 - \underset{(0.16)}{0.68} \frac{D_1}{M1} g_{D1}$$

$R^2$ = 0.75

Durbin-Watson test = 1.58

The coefficients on the interest rate variable, the income variable, the price variable, and the domestic credit variable are all comparable with those obtained in the former models. More specifically, the interest rate variable is negative, but not significantly different from zero, the income variable is positive, and we cannot reject the hypothesis of its being equal to + 1.0. The price variable is low, but positive and we cannot reject the hypothesis of its being + 1.0, due to its large standard error of .45. The domestic credit variable has a coefficient of - .68 and a standard error of .15, which implies that we cannot reject the hypothesis that this coefficient is - 1.0. All of the above tests were carried out at the .05 level of significance. The time dummy variable, T, enters with a coefficient of .06 and a standard error of .03, it is thus not significantly different from zero at the .05 level. The 1968 dummy variable, $T_3$, enters with a negative sign, but it is far from being significantly different from zero at

the .05 level. This seems to indicate that the effect of the devaluations first occurred in 1968, but this conclusion is very uncertain as the coefficients for the time dummy variables are not significantly different from zero. The Durbin-Watson tests fall in the inconclusive region for the test of no autocorrelation at the .05 level of significance.

5. Other evidence of effects of the 1967 devaluations.

To get a better idea of how much of the Norwegian trade was affected by the devaluation, we can look at which countries among Norway's major trade partners devalued in 1967:

| Country | Date |
|---|---|
| Denmark | 21st. of November 1967 |
| Finland | 12th. of October 1967 |
| Iceland | 27th. of November 1967 |
| Ireland | 18th. of November 1967 |
| United Kingdom | 18th. of November 1967 |

These countries collectively accounted for 22% of Norway's imports and 29% of Norway's exports in 1967.

It will also be of interest to see if the effect of the devaluations by these countries will show up in the shares they hold of Norway's exports and imports. We do, however, have to be careful when making such a comparison because the devaluations were not the only factors influencing this ratio. This is especially true for the year 1967. Norway, the United Kingdom, Denmark, and Finland were members of the European Free Trade Association, and on January 1st. 1967, virtually all protective tariffs on trade in industrial goods were abolished

between member countries.[27] This fact probably had a fairly strong effect on the trade pattern as relative prices changed. We will look at the movement of export and import shares for Denmark, Finland and the United Kingdom for the years 1966, 1967, 1968, and 1969.

TABLE V.1

IMPORT AND EXPORT SHARES

| Country | 1966 | | 1967 | | 1968 | | 1969 | |
|---|---|---|---|---|---|---|---|---|
| | I | E | I | E | I | E | I | E |
| Denmark | 5.8 | 7.1 | 6.3 | 7.9 | 6.8 | 7.1 | 6.5 | 7.3 |
| Finland | 1.1 | 2.1 | 1.4 | 2.1 | 1.7 | 1.8 | 1.8 | 2.5 |
| United Kingdom | 13.7 | 18.9 | 14.2 | 19.3 | 12.4 | 17.2 | 13.3 | 17.9 |

Source: Økonomisk Utsyn over Aaret 1971

Statistisk Sentralbyraa, Oslo, Norway, 1972.

where:

I = share of imports

E = share of exports

We note that the shares of exports for these three countries had been increasing up to 1967, but in 1968 the shares of exports dropped for all of them, and increased again in 1969. The pattern for imports is not as clear, but in general there was a continuing increase in the shares held by these countries. From this as well as from the regression results, it appears that Norway was affected to some extent by the devaluations by its major trade partners in 1967.

## Notes

[1]Estimation of equation (5.20) allowing for a constant term yielded somewhat different results even if the constant was not significantly different from zero at the .05 level. The estimated coefficients were closer to their expected values and the joint hypothesis could not be rejected. For estimation results see Table I, Appendix II.

[2]These models, forcing the regression line through the origin, are estimated using the ESP computer program. This program calculates the $R^2$'s in an equal manner for regression including and excluding the constant term. The formula used is:

$$R^2 = 1 - \frac{e'e}{(Y-\bar{Y})' (Y-\bar{Y})}$$

where:

e'e = residual sum of squares

Y = left hand variable

According to G. S. Maddala, Econometrics, McGraw-Hill, (20, 1977, p. 108), this calculation of $R^2$ is not correct for a regression excluding the constant term. For this reason, the $R^2$'s will not be relied upon to heavily.

[3]Proof of this test can be found in G. S. Maddala, Econometrics, (20, 1977, Appendix B).

[4]Leif Eide, Det Norske Penge og Kredittsystem, Norges Banks Skriftserie, Nr. 1, Oslo (10, 1973, pp. 23, 24).

[5]There were only minor changes in the estimated coefficients when a constant term was included. The constant term entered with a coefficient of - .006 and a standard error of .03. Thus, it is not significantly different from zero at the .05 level. For further results see Table II, Appendix II.

[6]Equation (5.25) was estimated including a constant term in the re-regression. The coefficient obtained for this constant was .04 with a standard error of .03, thus, we cannot reject the hypothesis of this variable's being equal to zero at the .05 level of significance. In spite of the insignificance of the constant term, its inclusion led to some changes in the other variables. The income variable turned negative and very small, and the price variable coefficient dropped, too. The domestic credit variable and the interest rate variables remained about the same A full report of the results is given in Table I, Appendix II.

[7]See Appendix III, Declaration on interest rate policy made by the Ministry of Finance in the National Assembly on December, 1965.

[8]A. Dammann (9, 1973, p. 358).

[9]A Dammann (9, 1973, p. 356), "The government chose to introduce a combined reserve requirement of primary and secondary liquid assets of 5 percent for the larger and medium-size savings banks and no reserve requirement of this kind for the smaller savings banks."

[10]The estimation of equation (5.26) including a constant term yielding a coefficient for the constant term not significantly different from zero at the .05 level of significance. The coefficient was - .011 and the standard error .037. The other variables remained nearly unchanged and none of the qualitative conclusions from the hypothesis tests were changed. For a full report of the results see Table I, Appendix II.

[11]Equation (5.27) was estimated including a constant term in the regression. Doing so resulted in a coefficient of - .001 for the constant together with a standard error of .03, which implies that we cannot reject the hypothesis that the constant is zero at the .05 level of significance. The explanatory variables entered with coefficients virtually equal to those in equation (5.27). For estimation results see Table II, Appendix II.

[12]Edward M. Syring (23, 1966, pp. 146, 147).

[13]Estimation of equation (5.28) including a constant term yielded an estimate of the constant of - .025 and a standard error of .051, the coefficient is not significantly different from zero at the .05 level. Including the constant term increased the income variable coefficient as well as its standarc error. For complete estimation results see Table I, Appendix II.

[14]Estimation of equation (5.30) including a constant term yielded an estimate of the constant of .004 and a standard error of .031, this constant is then not significantly different from zero at the .05 level significance. The income variable obtains a much larger standard error in this equation leading to a non-rejection of the hypothesis concerning this coefficient. The rest of the coefficients are similar to those obtained in eqution (5.30), see Table II, Apendix II.

[15]Estimation of equation (5.35) including a constant term gave an estimate of the constant not significantly different from zero at the .05 level of significance, but the coefficient was fairly high, - .11 and the standard error - .17. The coefficient that changed the most as a result of the inclusion of the constant term was the foreign income variable, which switched sign and increased its standard error considerably. For estimation see Table III, Appendix II.

[16]Estimation of equation (5.36) including a constant term yielded a estimate of the constant term of .009 and a standard error of .17. Thus, the constant is not significantly different from zero at the .05 level. The estimates as well as the standard errors for the explanatory variables, are very close to those obtained in equation (5.36). For estimation results see Appendix II, Table III.

[17]Equation (5.40) was estimated including a constant term, the coefficient of this constant was - .12 and it had a standard error of .15. Thus it is not significantly different from zero at the .05 level. The coefficient for world inflation changed from a negative .45 to a positive 1.36, but the standard error also increased to 2.49. The domestic credit variable was somewhat larger in absolute value and still negative, we would in fact have to accept the hypothesis of this coefficient being - 1.0 at the .05 level of significance. For full details on the estimated equation see Table III, Appendix II.

[18]Equation (5.42) was estimated including a constant term, the coefficient of this turned out to be .06 and it had a standard error of .04; thus, it is not significantly different from zero at the .05 level. Inclusion of this variable led to an increase in the absolute value of the income coefficient and a decrease in the absolute value of the interest rate coefficient. The sign of the foreign credit variable changed from positive to negative. The estimation results are reported in full in Table III, Appendix II.

[19]Estimation of equation (5.43) including a constant term gave an estimate of the constant of - .05 with a standard error of .15; thus, it is not significantly different from zero at the .05 level. The variable that changed the most with the inclusion of the constant term was the world price variable which changed from a negative .51 to a positive .26. The standard error of this variable increased at the same time from .65 to 2.51. The results of the estimation are reported in Table III, Appendix II.

[20]Estimation of equation (5.44) including a constant term yielded an estimate of the constant of .21 and a standard error of .29, which implies that it is not significantly different from zero at the .05 level. The foreign income variable changed drastically in magnitude with the inclusion of the constant term: it changed from a negative .10 to a negative 3.49 and the standard error increased considerably. The domestic income variable decreased in absolute value. The estimation results are given in Table III, Appendix II.

[21]Estimation of equation (5.44) including a constant term yielded an estimate of the constant term of - .04 and a standard error of .05, which implies that we cannot reject the hypothesis that this constant is zero at the .05 level. The coefficients for the rest of the explanatory variables were fairly similar to those obtained in the equation excluding the constant, equation (5.45). The estimation results are reported in Table I, Appendix II.

[22]Equation (5.46) was estimated introducing a constant term, this estimation resulted in a coefficient for the constant that was not singificantly different from zero at the .05 level. The estimated coefficients and standard errors were very similar to those obtained in equation (5.46). Table I, Appendix II gives the estimation results.

[23]Estimating equation (5.49) including a constant term yielded an estimate of the constant of - .02 and a standard error of .042, thus it is not significantly different from zero at the .05 level. The income variable coefficient turned out to be larger and had a larger standard error. The rest of the coefficients were similar to those obtained in equation (5.49). For estimation results see Table I, Appendix II.

[24]Estimation of equation (5.51) including a constant term, yielded an estimate of the constant of - .04 with a standard error of .05. Thus, this term is not significantly different from zero at the .05 level.

[25]Estimation of equation (5.53) including a constant term yielded an estimate of the constant that was not significantly different from zero at the .05 level. The explanatory variables obtained coefficients similar to those in equation (5.53). The results are given in Table I, Appendix II.

[26]Estimation of (5.55) including a constant term yielded the constant term not significantly different from zero at the .05 level. The coefficients of the explanatory variables changed to some extent as the income variable decreased and the price variable increased, but the conclusions of the hypothesis testing remained unchanged. The estimation results are reported in Table I, Appendix II.

[27]Økonomisk Utsyn over Aaret, 1967 (40, 1967, p. 142).

## CHAPTER VI

## A SIMULTANEOUS EQUATION MODEL FOR THE RESERVE FLOW

The single equation models treated above assume that the line of causation is from domestic credit to reserves, but arguments have been made for the reverse causation. That is, that the domestic authorities regulate the domestic credit in a way so as to offset any undesirable changes in foreign reserves and thus maintain the desired money supply. According to this hypothesis, a reserve inflow would induce a contraction of domestic credit. Two of the empirical studies that were reviewed earlier, have taken this possibility into consideration. M. Connolly and D. Taylor (1975) found evidence of sterilization behavior for developed countries. Their study is a cross-section study of devaluing countries. H. Genberg (14, 1976) tested the sterilization hypothesis for the case of Sweden and concluded that the hypothesis was not very likely to be true in that case.

To test the sterilization hypothesis for the case of Norway the following simultaneous equation model can be formed:

$$(6.1)\quad \frac{R}{M1}\, g_R = a_1 g_1 + a_2 g_p + a_3 g_Y + a_4 \frac{D1}{M1}\, g_{D1} + u,$$

and

$$(6.2)\quad \frac{D1}{M1}\, g_{D1} = b_1 \frac{R}{M1}\, g_R + u'$$

where all the variables are defined as earlier.

This system of equations is not identified, i.e., we cannot get estimates of all the parameters. The second equation by itself is identified and can be consistently estimated by two-stage least squares. Nothing much can be said about the first equation, which is due to the fairly large number of variables present in this equation. Equation (6.2) was estimated for the period of 1955-1970 and yielded the following result, using the two-stage least squares estimation procedure:

$$(6.3) \quad \frac{D1}{M1} \; g_{D1} = \underset{(0.66)}{0.83} \; \frac{R}{M1} \; g_R$$

The reserve coefficient is large and positive. According to the sterilization hypothesis, this coefficient should be - 1.0. The standard error of the coefficient is large, thereby making the coefficient not significantly different from zero at the .05 level of significance. On this background, there is serious doubt that Norway was following a sterilizing policy. To look further into this question of reverse causation, we can look at the institutional evidence. During the time period 1955 to 1970 there was a steady increase in Norway's holdings of foreign reserves except for the years 1961, 1962 and 1969.[1] In spite of this steady increase in foreign reserves, there was in most years a concern over the possibility of losing foreign reserves.[2] This concern was mainly due to the consistent deficit on the balance of trade that existed during most of this period.[3] This concern is expressed in the reason given for the increase in the discount rate in 1955, in Norges Bank gjennom 150 Aar, we read the following:

> The increase in the discount rate was a link in the policy to reduce investments, which was necessary to reduce the large deficit on the current account of the balance of payments.[4]

And underlying the reluctance aganist large deficits in the balance of payments is the fear of losing international reserves. This last thought is expressed in A. Dammann, "Monetary Policy in Norway," p. 333, which reads: "One might perhaps conclude that expansionary forces, with inflation on their tail, have been tolerated as long as they have not pushed up internal costs of production in such a degree as to reduce the competitiveness of the country's industries and to create a risk of a fall in foreign exchange reserves." We can now take a closer look at the actual situation in 1955. The economic policy which led to a decline in liquidity was chiefly a result of the raising of large public loans among the private credit institutions, a reduction in the issuing of building permits, and of the willingness of banks to restrict their lending.[5] This restrictive policy resulted in a decline in investments and a change in the development of the deficit on the current account. In this situation, imports of ships were still encouraged, but only if the currency were obtained abroad, that is, capital import was encouraged. This behavior by the authorities indicated a reaction pattern which is in complete contradiction to the neturalization hypothesis, even if it does not "prove" the theory since the threat of a loss in reserves never materialized. In addition, the concern with the balance of payments was not the only reason for following this policy. The effect of the restrictive policy, aimed at reducing investment demand, was still working in 1956 resulting in a rather modest internal demand. Combined with this internal development, the rest of the world experienced a boom, which resulted in a large demand for Norwegian exports. These developments together resulted in a balance of goods and services, which was roughly in equilibrium.[6] There was also an acceleration in international reserves. The next years in which the motivation with respect to Norway's

monetary policy was demonstrated were 1961 and 1962. These years were both characterized by high demand and a record high deficit on the balance of trade.[7] The monetary authorities feared an outflow of international reserves and stated the following goal for their credit policy, which can be found in Økonomisk Utsyn over Aaret 1962, p. 107:

> The government's purpose for limiting the supply of credit to the market has been to dampen the investment activity. The reasoning behind this is the wish to reduce the demand for goods and services in order to decrease the pressure on prices, wages and the foreign trade economy.

To reach this goal of decreased demand pressure, the credit policy was tightened in order to counteract the increase in demand for investment goods financed through loans. Restrictions were reintroduced on bank advances and it was agreed that bank advances should be reduced to a certain fixed amount before November of that year. This attempt to restrict the domestic credit failed, mainly due to the banks' possibilities of expansion in the foreign market.[8] As a consequence, foreign reserves started to flow out of the country. In reaction to this, new steps were taken in order to gain better control over loans in foreign currency from commercial banks and new limits were set for loans from commercial and savings banks.[9] In addition to these monetary restrictions, the volume of building activity licensed for 1962 was kept at the same level as the previous year. The effect of these measures was a substantial decrease in the growth rate of domestic credit and foreign reserves started to increase. In 1963, a more expansive policy was introduced, but concern was still expressed for the external economy's development:

> So far, it has been possible to finance balance of payments deficits without drawing on reserves of foreign reserves. But borrowing from abroad at the present rate is bound to create problems in the long run.

This statement can be found in Økonomisk Utsyn over Aaret 1963, (36, 1963, p. 136).

The preceding examples of Norwegian monetary policy indicate that the policy aimed at by the monetary authorities was the opposite of that indicated by the sterilization hypothesis. The fear of losing international reserves has dictated a decrease in the domestic credit as opposed to an increase as suggested by the sterilization hypothesis in order to keep the money supply stable. Since 1965, a somewhat different attitude seems to be present, but this appears to be due more to the fairly high level of foreign reserves accumulated by that time than to a fundamental change in philosophy. The policy now seems to lean more towards a sterilization, at least in theory. This new policy is expressed in Økonomisk Utsyn over Aaret 1965 p. 138 which reads:

> But with the build up of foreign exchange reserves that has taken place, Norway should have adequate freedom of maneuverability, if it is faced with a choice between regard for the internal level of activity and regard of the external balance.

The monetary policy in 1965 and 1968 was formed so as to restrict the credit financed demand pressure, and when the domestic credit increased to a larger extent than desired in 1966, new reserve requirements were introduced on the 17th of June, 1966.[10] Later that year, the commercial banks were required to keep additional reserves in the Bank of Norway if their loans exceeded a certain fixed limit.[11] This decreased concern with the possibility of a loss of international reserves was expressed again in 1967, when the effects of the 1967 devaluations by some of Norway's major trade partners were dealt with. In Økonomisk Utsyn over Aaret 1967, we find the following on p. 142:

> The devaluation of the pound sterling and some other currencies in November 1967 affected the purchasing

> power of Norway's holdings of foreign exchange and created a situation which gradually will influence the terms of trade in international commerce. This together with current changes in the structure of European customs duties will confront important sectors of Norwegian industry with substantially altered market and profitability conditions. How industry shall be able to adjust to these changes imposed by external conditions, without affecting the level of employment and production, will be one of the key problems in the Norwegian economy henceforth. In view of the current holdings of foreign exchange in Norway this problem will completely overshadow the problem of financing future large deficits in the balance of commodities and services.

The year 1968 was a slower year and to counteract the tendencies towards a decline in investments the government introduced a number of measures to stimulate that activity.[12] The development in 1969 and 1970 again called for restrictive monetary policy, this was, however, to a large extent due to a reorganization of the tax system.[13]

The development in monetary policy briefly discussed in the front indicates that the actions of the monetary authorities up to 1965 were heavily influenced by a fear of a loss of international reserves which induced policy actions contrary to those indicated by the neutralization hypothesis. From 1965 on, this fear was more depressed as the authorities felt that the level of foreign reserves accumulated at that point, was large enough to stand some strain. But the statements also indicate that if a substantial loss of international reserves should materialize, then a policy to counteract this loss would be implemented. Based on this institutional evidence and on the two-stage least squares estimates of the domestic credit relationship in equation (6.2) it seems that we can reject the sterilization hypothesis for the case of Norway. This implies that the single equation reserve flow models will not be subject to a simultaneous equation bias for this reason.

## Notes

[1]See data for foreign reserves source, International Financial Statistic (17).

[2]A. Dammann (9, 1973, p. 333).

[3]A. Dammann (9, 1973, p. 349).

[4]Translated from Norwegian by the author.

[5]Økonomisk Utsyn over Aaret 1955 (28, 1955, p. 137).

[6]Økonomisk Utsyn over Aaret 1956 (29, 1956, p. 131).

[7]Økonomisk Utsyn over Aaret 1962 (35, 1962, p. 133).

[8]A. Dammann (9, 1973, p. 353).

[9]A. Dammann (9, 1973, p. 354).

[10]Økonomisk Utsyn over Aaret 1966 (39, 1966, pp. 112-113).

[11]Økonomisk Utsyn over Aaret 1966 (39, 1966, pp. 112-113).

[12]Økonomisk Utsyn over Aaret 1968 (41, 1968, p. 135).

[13]Økonomisk Utsyn over Aaret 1970 (43, 1970, p. 133).

APPENDIX I

A SHORT REVIEW OF THE HISTORY OF THE NORWEGIAN BANK SYSTEM

After having been united with Sweden and/or Denmark since 1319, Norway once again became an independent country in 1814, even though it shared a common King with Sweden until 1905. Until 1814, Norway had a common currency with Denmark and, thus, was faced with the task of forming a completely new monetary system after independence.[1] The first financial institution "Credittkassen," was founded in 1775, but this was not an independent Norwegian bank. It operated more like a lending department under a Danish bank. Later, other Danish-Norwegian banks were established. In 1816, the Bank of Norway was established[2] and its currency was linked to a silver fund. This silver fund was obtained through expropriation from the citizens. In return for this silver, the bank issued shares which gave the owner a right to a dividend but no influence over the management of the bank.[3] The Bank of Norway was given the right to print money in a fixed proportion to the silver fund. This fixed proportion was changed several times during the period 1800-1900.

In the early years, the Bank of Norway operated both as a currency issuing bank and as an ordinary lending bank.[4] In the 1860's the commercial banks started to dominate the Bank of Norway in issuing

credit to industry . Moreover, the mortgage market increasingly was dominated by the savings banks and the government bank, which was established just for that purpose.[5]

In the 1870's, Norway's currency switched from being linked to silver to being linked to gold.[6] In 1914, the gold convertibility privilege was suspended due to the panic created by the outbreak of the First World War.[7] The gold convertibility privilege was reinstated in 1928,[8] but in 1931 it was again suspended and this time the government did not consider it a goal to get the gold convertibility reinstated.[9] The Norwegian currency was, however, linked to the English and the American currencies.

During the Second World War, the Bank of Norway operated in two separate places. The operation in German-occupied Norway was aimed at maintaining production and consumption in the country. The part of the Bank that operated out of London had, as its main task, to handle the Bank's foreign values.[10] At the end of the Second World War, there existed a considerable surplus of money due to the German money printing policy.[11] An immediate task was to decrease this surplus. In 1949, the Norwegian currency was devalued. In the same year, the Government bought all the shares in the Bank of Norway. This had no real impact, however, since the shareholders never had any real influence. Since that time, the Bank of Norway has not been operating as a lending bank and does not receive deposits from the public, except in some special cases.[12] In addition to still being the currency issuing agency, the current tasks of the Bank of Norway are those of being an advisor to the government on monetary matters and an executor of government policy.[13] The Bank of Norway is involved in the control

of the money supply in cooperating with other government agencies. The specific tasks are spelled out in more detail in the section on the explanation of the Norwegian Bank System.

The Historical Development of the Rest of the Banking System

To get an idea of the development of the relative importance of the different types of banks during the period 1950-1970, we can look at the development of their shares in the loan market.

TABLE I.1

SHARES OF THE LOAN MARKET

| Institution | 1950 | 1955 | 1960 | 1965 | 1970 |
|---|---|---|---|---|---|
| Bank of Norway | 0.48 | 0.76 | 0.34 | 0.25 | 0.22 |
| Total Government Banks | 21.63 | 29.58 | 30.21 | 29.78 | 31.45 |
| Commercial Banks | 36.61 | 30.62 | 27.98 | 27.59 | 26.44 |
| Savings Banks | 25.20 | 23.46 | 23.55 | 22.22 | 22.03 |
| Loan Associations | 9.07 | 8.36 | 8.03 | 8.83 | 9.46 |
| Life Insurance Companies | 7.48 | 7.98 | 10.23 | 11.57 | 10.62 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Source: Statistisk Arbok (29), Statistisk Santralbyro, Oslo Norway.

This tells us that there has been an increase in the share of the government banks, a decrease for commercial banks, and a small decrease for savings banks. Loan Associations and Life Insurance Companies

have both increased their shares since 1950, but they are of relatively small importance as their combined share was only 20.08% of the market. Government Banks showed the strongest increase in market share, which was the result of active government policy. In 1970, the group, government banks, consisted of eight different banks: The Government Bank of Agriculture, The Fishermen's Bank, The Housing Bank, The Manufacturing Bank, The Municipal Bank, The Student's Loan Fund, The Regional Development Fund and The Post Office Bank.[14] By far, the largest is the Housing Bank. The reasons behind the development of Government Banks are several, but the more important ones were the desires to guarantee credit to special sectors of the economy and in some cases to subsidize the special sectors through low interest rate loans. These sectors were defined on either occupational, regional or social criteria. The Fishermen's Bank is an example of the first type and the Regional Development Fund is an example of the second type while the Student's Loan Fund belongs to the third category.[15]

Branch banking is legal in Norway. This opportunity has been specially utilized by the commercial banks and the insurance companies.[16] The number of commercial banks has decreased steadily since 1950 and reached 40 banks in 1970, which is about half the number of banks in 1950. The number of savings banks is larger, 493 savings banks were in operation in 1970, this number, has, however also been decreasing since 1960. The background for this large number of savings banks can be found in Norway's topography, there is as a basic rule one savings bank in each community.[17]

The Commercial banks and the Savings banks differ in organizational structure. A savings bank is a self-owned institution, where the

# THE NORWEGIAN BANK SYSTEM

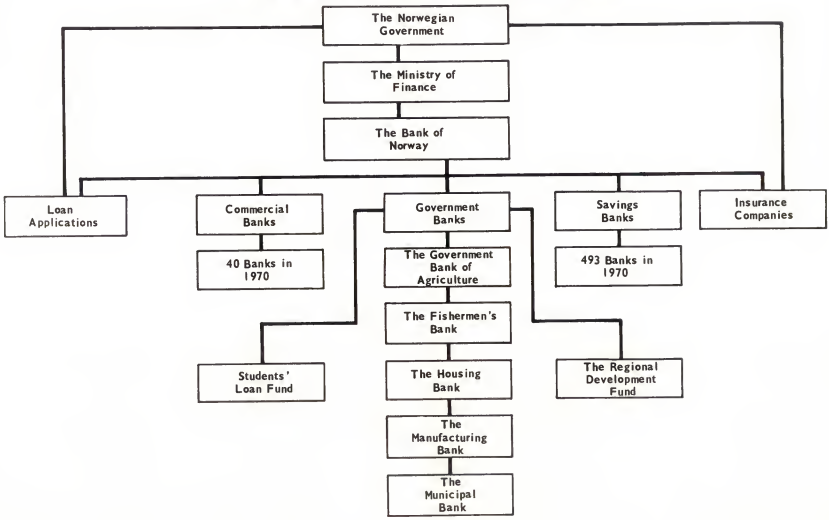



Figure 1

original contributions have been paid off and a capital fund has build up through annual profits. As a consequence, these banks pay no dividends; instead, they generally spend part of their profits on charitable gifts and donations for community purposes.[18] A commercial bank, on the other hand, is organized as a joint stock company with at least twenty shareholders.[19] When a commercial bank exceeds a certain size it is regulated more directly in the sense that one-fourth of the Board members are to be named by the Government. The two types of banks differ to some extent in the composition of their assets and liabilities, with savings banks holding a larger share of time deposits and commercial banks a larger share of demand deposits. In their lending savings banks have traditionally concentrated more on mortgage loans and loans to agriculture and forestry, on a well secured basis, while the commercial banks have been the most important source of credit for industry, commerce and shipping. These differences have grown smaller during this period.

## Notes

[1]Norges Bank gjennom 150 Aar (11, 1966, p. 3).

[2]Norges Bank gjennom 150 Aar (11, 1966, p. 14).

[3]Norges Bank gjennom 150 Aar (11, 1966, p. 15)

[4]E. M. Syring (23, 1966, p. 87); Norges Bank gjennom 150 Aar, (11, 1966, p. 30).

[5]Norges Bank gjennom 150 Aar (11, 1966, pp. 83, 85).

[6]Norges Bank gjennom 150 Aar (11, 1966, p. 119).

[7]Norges Bank gjennom 150 Aar (11, 1966, p. 179).

[8]Norges Bank gjennom 150 Aar (11, 1966, p. 26).

[9]Norges Bank gjennom 150 Aar (11, 1966, p. 287).

[10]Norges Bank gjennom 150 Aar (11, 1966, pp. 299-341).

[11]Norges Bank gjennom 150 Aar (11, 1966, p. 351).

[12]A. Dammann (9, 1973, p. 330).

[13]L. Eide (10, 1973, p. 7).

[14]L. Eide (10, 1973, p. 12).

[15]L. Eide (10, 1973, p. 11).

[16]L. Eide (10, 1973, p. 15).

[17]L. Eide (10, 1973, p. 11).

[18]A. Dammann (9, 1973, p. 334).

[19]A. Dammann (9, 1973, p. 335).

# APPENDIX II

## RESULTS FROM THE ESTIMATION OF THE RESERVE FLOW EQUATIONS INCLUDING A CONSTANT TERM

TABLE I

ESTIMATION RESULTS OF RESERVE FLOW EQUATIONS
INCLUDING CONSTANT TERM, NARROW DEFINITION OF MONEY
1955 to 1970

| Dependent Variable | C | $g_{Y(z)}$ | $g_{i(z)}$ | $g_p$ | $\frac{D_1(z)}{M_1(z)} g_{D_1(z)}$ | WINF | T | T1 | T3 | NGY | WI | S | D-W | $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\frac{R}{M1} g_R$ | -.04 (.04)+ | 1.30* (.67) | | | -.71* (.16) | -.31 (.93) | | | | | | | 2.03 | .65 |
| $\frac{R}{M1} g_R$ | -.02 (.04) | .83 (.62) | -.23 (.71) | .24 (.44) | -.72* (.15) | | .06 (.03) | | | | | | 1.68 | .75 |
| $\frac{R}{M1} g_R$ | -.02 (.05) | .82 (.78) | -.03 (.08) | .27 (.44) | -.73* (.18) | | | .03 (.03) | | | | | 2.21 | .67 |
| $\frac{R}{M1} g_R$ | -.03 (.05) | .95 (.72) | -.01 (.08) | .16 (.50) | -.71* (.17) | | .05 (.03) | -.02 (.04) | | | | | 1.52 | .76 |
| $\frac{R}{M1} g_R$ | -.03 (.06) | 1.11 (.68) | -.01 (.08) | .09 (.48) | -.70* (.17) | | | | | | | | 2.01 | .65 |
| $\frac{R}{M1} g_R$ | -.03 (.05) | .95 (.75) | -.01 (.08) | .18 (.52) | -.66* (.19) | | | | | | | -.001 (.002) | 2.05 | .66 |
| $\frac{R}{M1} g_R$ | -.04 (.03) | | -.04 (.09) | .52 (.46) | -.56* (.17) | | | | | -.05 (.32) | | | 1.78 | .56 |
| $\frac{R}{M1} g_R$ | -.05 (.05) | 1.30 (.68) | | -.04 (.46) | -.68* (.17) | | | | -.03 (.04) | | | | 1.49 | .68 |

TABLE I (Cont'd)

| Dependent variable | C | $g_{Y(z)}$ | $g_{i(z)}$ | $g_p$ | $\frac{D_1(z)}{M_1(z)} g_{D_1(z)}$ | WINF | T | T1 | T3 | NGY | WI | S | D-W | $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $Y_R$ | -.05<br>(.01) | | -.10<br>(.09) | | | | | | -.01<br>(.04) | | | | 2.08 | .11 |
| $Y_R$ | -.05<br>(.01) | | -.10<br>(.08) | | | | | | | | | | 1.99 | .10 |
| $Y_R$ | -.05<br>(.009) | | -.09<br>(.07) | | | | .07*<br>(.03) | | | | | | 1.80 | .34 |

*Coefficient is significantly different from zero at the .05 level

†Standard errors are reported under the coefficients.

TABLE I (Cont'd)

1955 to 1965

| Dependent Variable | C | $g_{Y(z)}$ | $g_{i(z)}$ | $g_p$ | $\frac{D_i(z)}{M_i(z)} g_{D_1(z)}$ | WINF | NGY | S | D-W | $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| $\frac{R}{M1} g_R$ | .06<br>(.03) | | -.07<br>(.08) | -.23<br>(.20) | -.77*<br>(.20) | | -.08<br>(.31) | | 1.26 | .78 |
| $\frac{R}{M1} g_R$ | .003<br>(.04) | 1.08<br>(.68) | -.02<br>(.08) | | -.84*<br>(.17) | -1.15<br>(1.07) | | | 2.33 | .84 |
| $\frac{R}{M1} g_R$ | .001<br>(.04) | 1.16<br>(.58) | | | -.83*<br>(.15) | -1.30<br>(.86) | | | 2.32 | .84 |
| $\frac{R}{M1} g_R$ | -.01<br>(.04) | 1.25*<br>(.59) | -.05<br>(.54) | -.95<br>(.54) | -.90*<br>(.15) | | | | 2.31 | .88 |
| $\frac{R}{M1} g_R$ | -.005<br>(.04) | 1.19<br>(.62) | -.04<br>(.06) | -.93<br>(.56 | -.84*<br>(.18) | | | -.002<br>(.002) | 1.97 | .90 |
| $Y_R$ | -.05<br>(.01) | | -1.0<br>(.09 | | | | | | 1.68 | .13 |

TABLE II

ESTIMATION RESULTS OF RESERVE FLOW EQUATIONS
INCLUDING CONSTANT TERM, BROAD DEFINITION OF MONEY
1955 to 1970

| Dependent Variable | C | $g_{Y(z)}$ | $g_{i(z)}$ | $g_p$ | $\frac{D_{2(z)}}{M_{2(z)}} g_{D_2}$ | WINF | WI | S | D-W | $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| $\frac{R}{M2} g_R$ | -.006<br>(.03) | .49<br>(.50) | .02<br>(.05) | .21<br>(.29) | -.42<br>(.23) | | | | 1.91 | .32 |
| $\frac{R}{M2} g_R$ | -.004<br>(.03) | .31<br>(.51) | -.02<br>(.05) | .28<br>(.30) | -.36<br>(.23) | | | -.0015<br>(.0013) | 2.23 | .41 |
| $\frac{R}{M2} g_R$ | -.007<br>(.03) | .84<br>(.57) | .01<br>(.06) | | -.80*<br>(.33) | -.54<br>(.33) | | | 1.91 | .59 |

* Coefficient is significantly different from zero at the .05 level.

TABLE II (Cont'd)

1955 to 1965

| Dependent variable | C | $g_{Y(z)}$ | $g_{i(z)}$ | $g_p$ | $\frac{D_2}{M_2} g_{D_2}$ | WINF | WI | S | D-W | $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| $\frac{R}{M2} g_R$ | .007<br>(.03) | .84<br>(.56) | .01<br>(.06) | | -.80*<br>(.33) | -.54<br>(.78) | | | 1.91 | .59 |
| $\frac{R}{M2} g_R$ | -.001<br>(.03) | 1.11<br>(.56) | -.0003<br>(.04) | -.58<br>(.43) | -.97*<br>(.32) | | | | 2.02 | .67 |
| $\frac{R}{M2} g_R$ | .004<br>(.03) | .99<br>(.51) | .003<br>(.04) | -.56<br>(.39) | -.84*<br>(.31) | | | -.002<br>(.001) | 1.44 | .78 |

*Coefficient is significantly different from zero at the .05 level

TABLE III

ESTIMATION RESULTS OF RESERVE FLOW EQUATIONS
INCLUDING CONSTANT TERM AND WORLD RELATIONS
NARROW DEFINITION OF MONEY
1955 to 1970

| Dependent Variable | C | $g_{Y(z)}$ | $g_{Y(f)}$ | $g_{i(z)}$ | $\frac{D_1(f)}{M1(f)} g_{D_1(f)}$ | $\frac{D_1(z)}{M1(z)} g_{D(z)}$ | $\frac{D_1(f)}{M1(f)} g_{D_1(f)}$ | $g_{Y(f)}-g_{Y(z)}$ | D-W | $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| $\frac{R}{M1} g_R$ | -.11<br>(.16) | .81<br>(1.04) | 1.32<br>(2.65) | -.009<br>(.10) | -.05<br>(.42) | -.75*<br>(.20) | | | 2.01 | .66 |
| $\frac{R}{M1} g_R$ | -.009<br>(.17) | 1.60<br>(1.09) | -.30<br>(2.69) | -.06<br>(.08) | | -.80*<br>(.18) | -.43<br>(.32) | | 2.06 | .72 |
| $\frac{R}{M1} g_R$ | -.12<br>(.15) | .79<br>(.96) | 1.36<br>(2.49) | | -.02<br>(.30) | -.75*<br>(.18) | | | 1.96 | .66 |
| $\frac{R}{M1} g_R$ | -.05<br>(.15) | 1.36<br>(1.01) | .26<br>(2.51) | | | -.76*<br>(.17) | -.32<br>(.27) | | 1.94 | .70 |
| $\frac{R}{M1} g_R$ | -.07<br>(.04) | | | -.02<br>(.10) | -.05<br>(.43) | -.64*<br>(.17) | | -1.42<br>(.89) | 2.06 | .61 |
| $\frac{R}{M1} g_R$ | .06<br>(.03) | | | | -.002<br>(.30) | -.63*<br>(.15) | | -1.38<br>(.82) | 1.98 | .61 |
| $\frac{R}{M1} g_R$ | .09<br>(.02) | | | | | .68*<br>(.14) | -.38<br>(.26) | -1.91*<br>(.80) | 2.08 | .67 |

*Coefficient is significantly different from zero at the .05 level

**The unweighted measure of foreign credit is used in the estimation

TABLE IV

ESTIMATION RESULTS OF RESERVE FLOW EQUATIONS
INCLUDING A CONSTANT TERM, WORLD RELATIONS AND
USING THE BROAD DEFINITION OF MONEY
1955 to 1970

| Dependent Variable | C | $g_{Y(z)}$ | $g_{Y(f)}$ | $g_{i(z)}$ | $\frac{D_{2(f)}}{M_{z(f)}} g_{D_{2(f)}}$ | $\frac{D_{2(z)}}{M_{2(f)}} g_{D_{2(z)}}$* | $\frac{D_{2(f)}}{M_{2(f)}}$** $g_{D_{2(f)}}$ | $g_{Y(f)}-g_{Y(z)}$ | D-W | $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| $\frac{R}{M2} g_R$ | .002<br>(.11) | .43<br>(.62) | -.35<br>(1.78) | .06<br>(.05) | .26<br>(.26) | -.26<br>(.32) | | | 1.52 | .36 |
| $\frac{R}{M2} g_R$ | -.03<br>(.12) | .46<br>(.66) | .21<br>(1.78) | .05<br>(.05) | | -.39<br>(.29) | .13<br>(.24) | | 1.78 | .31 |
| $\frac{R}{M2} g_R$ | .02<br>(.11) | .54<br>(.63 | -.35<br>(1.82) | | | -.35<br>(.31) | .10<br>(.23) | | 1.72 | .26 |
| $\frac{R}{M2} g_R$ | .04<br>(.03) | | | | | -.34<br>(.19) | .04<br>(.20) | -.62<br>(.60) | 1.92 | .24 |
| $\frac{R}{M2} g_R$ | .03<br>(.02) | | | | .11<br>(.19) | -.32<br>(.19) | | -.55<br>(.59) | 1.73 | .26 |

*Coefficient is significantly different from zero at the .05 level

**The unweighted measure of foreign credit is used in the equation.

TABLE IV (Cont'd)

1955 to 1965

| Dependent Variable | C | $g_{Y(z)}$ | $g_{Y(f)}$ | $g_{i(z)}$ | $\frac{D2(f)}{M2(f)}\ g_{D_{2(f)}}$ | $\frac{D2(z)}{M2(z)}\ g_{D_{2(z)}}$ | $\frac{D2(f)}{M2(f)}\ g^{**}_{D_{2(f)}}$ | $g_{Y(f)}-g_{Y(z)}$ | D-W | $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| $\frac{R}{M2}\ g_R$ | .23<br>(.16) | 1.47<br>(.81) | -3.80<br>(2.69) | -.03<br>(.07) | .18<br>(.14) | -.53<br>(.41) | | | 2.07 | .70 |
| $\frac{R}{M2}\ g_R$ | .23<br>(.14) | 1.65<br>(.77) | -3.48<br>(2.31) | -.07<br>(.59) | | -.68*<br>(.31) | -.23<br>(.26) | | 2.78 | .74 |
| $\frac{R}{M2}\ g_R$ | .20<br>(.14) | 1.28<br>(.66) | -3.52<br>(2.42) | | .30<br>(.31) | -.45<br>(.34) | | | 1.76 | .68 |
| $\frac{R}{M2}\ g_R$ | .07<br>(.02) | | | | | -.71*<br>(.24) | -.13<br>(.23) | -.99<br>(.54) | 2.13 | .62 |
| $\frac{R}{M2}\ g_R$ | .05<br>(.24 | | | | .05<br>(.22) | -.72*<br>(.24) | | -.92<br>(.58) | 1.85 | .60 |

* Coefficient is significantly different from zero at the .05 level.

**The Unweighted measure of foreign credit is sued in the equation.

APPENDIX III

THE LAW CONCERNING THE AUTHORITY TO REGULATE
MONETARY AND CREDIT CONDITIONS
(June 25, 1965)

## Chapter 1. General Considerations

### 1

The King shall have the authority to issue regulations concerning liquidity reserves, foreign-exchange reserves, supplementary reserves, bond placement requirements, direct control of lending of certain credit institutions, maximum interest rates on loans, and bond issue control. The Department of Finance shall stipulate regulations concerning the issue of financial statements by certain credit institutions and the issue of statements with regard to interest rates.

### 2

Each year the King shall send the Storting (Parliament) guidelines for monetary and credit policy for the coming year. Moreover, the King shall explain to the Storting the policy measures which have been taken during the previous year.

The guidelines which are sent to the Storting must not be altered in any essential way unless special authorization is made. However, changes may be made if, in light of the current economic situation, it is deemed indefensible to wait for special authorization. In such cases, the Storting shall be advised immediately of the changes.

3

Before the King issues regulations under authority of this law, the Bank of Norway shall have the opportunity to express its views.

## Chapter 2. Commercial and Savings Banks' Liquidity Reserves, Foreign-Exchange Reserves, and Supplementary Reserves

4

The King shall have the authority to require commercial and savings banks to hold reserves of primary and secondary liquid assets. The reserves shall comprise a certain percent of the banks' total liabilities, with the exception of certain credit obligations and assessed but unpaid taxes.

5

Primary reserves shall consist of banks' cash holdings, deposits in the Bank of Norway, deposits in the Post-Giro System, and Treasury bills.

Secondary reserves shall consist of Norwegian Government bonds. Bond holdings shall be valued according to balance-sheet figures, or in any case not higher than current market value.

The primary reserve requirement shall not be set highere than 15 per cent for commercial banks and 10 per cent for savings banks. The requirement rate for the sum of primary and secondary reserves shall not be set higher than 25 per cent for commercial banks and 40 per cent for savings banks. Different reserve rates may be set for commercial and savings banks, and according to banks' total assets and geographic location.

6

Liquidity reserve shall be calculated on the basis of a bank's position at the end of each month. If reserves are deficient, this deficiency shall be corrected before the end of the following month.

The King may decide that within a certain time period, not to exceed 12 months, deficient and excess reserves may be allowed to balance out.

7

The King may decide that commercial and savings banks shall be required to hold foreign-exchange reserves calculated on the basis of the rise in deposits and loans from foreign depositors and lenders. Increases shall be reckoned at the earliest from the time the King decides to issue regulations in accordance with this paragraph. Foreign-exchange reserves shall consist of separate deposits in the Bank of Norway.

Different foreign-exchange reserve rates may be established for loans and deposits with greater and less than 12 months maturity. The reserve rate must not exceed 100 per cent.

8

The King may decide that commercial and savings banks shall hold supplementary reserves in separate deposits at the Bank of Norway. The supplementary reserves shall be based upon increases in bank loans. The King shall establish rules for calculating increases in loans, including the time from which these increases shall be reckoned.

Different supplementary reserve rates may be set for commercial

and savings banks, for different types of loans, and according to banks' total assets and geographic location. The rate must not exceed 100 per cent.

## Chapter 3. Bond Placement Requirements

9

The King may require that certain institutions - commercial and savings banks, life insurance companies, municipal and private pension plans, and various other pension funds - shall not reduce their holdings of Norwegian Government bonds and other Norwegian bearer bonds. This applies only to those institutions whose bond holdings are less than a certain per cent of their total assets - 20 percent for commercial banks, 40 per cent for savings banks, and 60 per cent for the other institutions.

The King may decide that the above-mentioned institutions shall increase their holdings of Government or other Norwegian bonds for up to 60 per cent of an eventual rise in their respective total assets, until the bond holding limits mentioned in the last paragraph are reached. The King may require that a certain minimum fraction of the increase in bond holdings consists of Norwegian Government bonds.

The above requirements may be established differently for diverse groups of credit institutions and according to institutions' total assets and geographic location.

If an institution experiences a fall in total assets, it may reduce its bond holdings according to rules established by the King. These rules also may be set differently in accordance with the previous paragraph.

Bond holdings shall be reckoned according to balance-sheet values. Calculation of bond holdings and of increases in total assets shall be made, at the earliest, when the King applies the requirements contained in this paragraph.

10

Bond placement requirements shall be calculated on the basis of reports from the institutions concerned at the end of each quarter, and the requirements must be fulfilled by the end of the following quarter. The Department of Finance shall give more detailed provisions concerning which assets shall form the basis for the calculation of the bond requirement.

## Chapter 4. Reporting Requirements and Direct Lending Regulation of Certain Credit Institutions

11

The Department of Finance can decide that companies and foundations whose purpose is to issue or negotiate credit or to guarantee loans shall issue statements to the Bank of Norway concerning their activities and how they are financed.

Excluding from this reporting requirement are those institutions mentioned in paragraph 9, and non-life insurance companies, credit and mortgage associations, and the state banks.

In case of doubt, the Department of Finance shall decide whether a company or foundation shall be required to issue a report.

12

The King can issue provisions for the direct regulation of the extent of lending by the institutions mentioned in paragraph 11 and by non-insurance companies.

## Chapter 5. Interest Rate Regulation and Bond Issue Control

13

The Department of Finance shall have the authority to decide that commercial and savings banks, life and non-life insurance companies, municipal and private pension plans, other pension funds, credit and mortgage associations, and other institutions whose purpose is to issue or negotiate credit shall be required to issue reports to the Bank of Norway concerning interest rates which they apply on loans and deposits.

In case of doubt, the Department of Finance shall decide whether an institution is to be covered by this regulation.

14

The King may issue provisions concerning maximum interest and commission rates for different types of loans. Certain exceptions may be made. Similarly, the King may require that no changes be made in these rates without approval of the Bank of Norway.

This paragraph is not applicable to interest and commission rates governed by other paragraphs in this law or by other laws.

15

The King shall have the authority to require that bearer bonds or other similar debt instruments shall not be floated on the open market without prior approval of the Department of Finance.

## Chapter 6. Supervision, Penalty Rates, and Other Penalty Provisions

16

The King shall issue provisions concerning supervision, in order to insure that this law's requirements are met.

The institutions covered by this law shall be required to give the supervisory authority the information which is required for proper control.

The supervisory authorities shall have access to the institutions' books.

The supervisory authorities are requried to keep confidential the information gathered in the course of their work.

17

Should liquidity reserves, foreign-exchange reserves, or supplementary reserves fall below required levels, or bond holdings be less than required, or loans greater than stipulated, the violating institution shall be required to pay penalty interest to the Treasury, according to rates established by the King.

18

Any institution that is continually in violation of the requirements contained in paragraphs 11, 13, 14, and 15, shall be subject to fine.

If a violation has been caused by an institution acting in behalf of a company or foundation, the latter also shall be subject to fine.

## Chapter 7. When the law shall become Operative

19

This law shall become operative at the decision of the King. At such time, the temporary law of July 17, 1953, concerning the regulation of interest and commission rates shall be repealed.

The law of June 28, 1953, concerning commercial and savings banks' deposit reserves in the Bank of Norway shall be repealed within three months after the King has issued provisions contained in paragraph 4 of this law.

Main Guiding Principles for Credit Policy
in the Period 1960 to 1964

1) The liquidity of the credit systems shall be maintained at a level no higher than adequate for a justifiable growth in the volume of credit. It will be endeavored to attain this objective through the following measures:

   i) The credit institution - the commercial banks, the savings banks and the life insurance companies - shall reinvest in Government and Governemnt-guaranteed bonds amounts received in the form of redemption and installment payments on existing securities of these categories.

   ii) Norges Bank shall supply liquidity, inter alia, by purchase of bonds, should be liquidity be so reduced, by, for instance, developments in the foreign economy, that the reduced lending capacity of the private credit institutions would endanger the general level of activity.

   iii) The private banks shall be able to obtain short-term liquidity loans in Norges Bank, according to the principles which have hitherto applied.

2) The commercial banks shall maintain their holdings of Government and Government-guaranteed bonds at no less than the level on December 1, 1959.

3) Under similar assumptions as in Norges Bank's previous guiding principles for lending activities, etc., the savings banks agree to increase their holdings of Government securities by a certain percentage of the increase in depostis. The percentage for each year shall be decided after discussions in the Joint Consultation Council, but it shall not be higher than 50 per cent. Accumulated interest at year's end shall not be counted as increases in deposits in the savings banks.

4) The life insurance companies agree to make new subscriptions to government loans and to increase their holdings of Government and Government-guaranteed bonds by amounts fixed annually in proportion to the increase in total resources of the companies. The amount for new subscriptions to Government loans shall not be higher than 110 million kroner, and that for increase in holdings of Government-guaranteed bonds not higher than 100 million kroner.

5) i) Rates of interest and other terms in the new Government loans shall be fixed as in recent years by special agreement.

ii) The rates of interest agreed under (i) shall be regarded as norms also for interest on mortgage loans and for interest on other bond issues.

iii) As long as the savings banks undertake to maintain and to increase their holdings of bonds according to (1) and (3), a discount rate clause shall be included in at least one type of Government bonds.

iv) Changes in interest rates of the credit institutions on depostis and advances shall only be made after advance discussion in the Joint Consultation Council, in order that arrangements made shall give due consideration to all parties.

6) Control of the floating of bond issues under paragraph 3 of the Interest Act shall be maintained. Aggregate ceilings for such issues will be established following prior discussions in the Joint Consultation Council.

7) i) The provisions issued by Royal Decree of January 14, 1955, under the Act of June 28, 1952, concerning obligatory reserves with Norges Bank shall be amended as follows: "All savings banks are exempted from the obligatory reserves with Norges Bank under the Act of June 28, 1952, paragraph 1."

ii) The representatives of the banks agree that in order to counteract an undesirable credit expansion as described in the foregoing, a system be established whereby the banks can be subjected to an extended obligation to maintain deposit reserves in Norges Bank.

8) Following discussion in the Joint Consultation Council, guiding principles for the lending activities of the credit institutions shall be established for each year individually. In deciding on loan applications the credit institutions shall have special regard for the following main principles:

   i) They will endeavor to contribute to facilitating the reorganization of business which might be necessary in connection with Norway's participation in EFTA. This applies equally to credits for financing of investment as for financing for exports.

   ii) They will endeavor to contribute to the necessary supply of capital to local areas in process of development.

   iii) They will show restraint in the provision of personal credits, including personal loans.

   iv) They will assist private borrowers in obtaining credits abroad.

9) Should the implementation and observance of the agreement, or economic developments, turn out to deviate substantially from the assumptions, the parties to the agreement can call for negotiations in the Joine Consultation Council on amendments or additions to points 1-8 above.

## Guidelines for Monetary Policy 1955-1960

As a result of the discussions in the Joint Consultation Council, the Norges Bank in a circular letter of December 15 this year to the Norwegian joint stock and savings banks, drew up new guiding principles for the lending activities of the banks in 1956 and 1957. The general objective of these new principles is that the total bank loans in 1956 and 1957 shall not exceed the 1955 level. The assumption is that, as a rule, an increase in the total resources as a result of new deposits should not be reflected in a further rise in loans. It is assumed, furthermore, that the joint stock banks will place such deposit increases in Treasury bills or in short-term Government or Government-guaranteed bonds. It is also assumed that the savings banks will increase their holdings of Government and Government-guaranteed bonds by at least 50 per cent of the deposit increase, and that both the joint stock banks and the savings banks will reinvest instalments on Government and Government-guaranteed bonds in new bonds of the same categories.

At the same time the Ministry of Finance and the Association of Norwegian Life Insurance Companies, on the basis of the discussions in the Joint Consultation Council, have agreed that the life insurance companies in 1956/57 will grant the Government loans totalling 225 million kroner.

By the end of 1957 the companies shall have increased their holdings of Government and Government-guaranteed bonds by at least 200 million kroner compared to the amount on November 1, 1955.

The objective of the new guiding principles for the lending policy is to prevent a further credit expansion. The arrangement will at the same time entail that the State banks will get the necessary funds in 1955/57 to meet their loan commitments according to the budgets fixed by the Government and the Storting (National Assembly).

The Minister of Finance, who has been kept informed of the discussion in the Joint Consultation Council, has declared that, provided the new principles for the lending activities of the banks are carried out according to the underlying assumptions of the negotiations, new legislation concerning statutory reserves will not be introduced. Nor will the Ministry propose legislation requiring life insurance companies to place the increase in their resources in Government and Government-guaranteed bonds.

The Declaration on interest rate policy made
by the Ministry of Finance in the National Assembly
on December 1965

"Under the framework agreement and the annual credit agreements entered into by the Joint Consultation Council, the commercial and savings banks, and the life insurance companies on the one hand, and the authorities on the other, agreed upon basing the rate of interest for many important types of loans on certain standard interest rates. These standards have been regarded as maximum rates. For many years both commercial and savings banks and life insurance companies on the whole kept to these standard rates of interest, even if some of the other credit institutions have shown a tendency to apply higher rates.

Among the principal rates of interest for which standard levels have been stipulated in this way, the following are mentioned:

| | | |
|---|---|---|
| First mortgages on dwellings | Maximum | 5 % |
| Municipal debenture loans | " | 5 % |
| Government-guaranteed mortgages | " | 5 % |
| Second mortgages (first mortgages from the State housing banks) | " | 5½ % |
| Guaranteed second mortgages (first mortgages from the State housing banks) | " | 5 % |
| Cash credits and building loans from commercial and savings banks (including commercial) | " | 6 % |
| Long-term Government loans | " | 5 % |
| Long-term Government-guaranteed bond loans | " | 5 % |

| | | |
|---|---|---|
| Long-term municipal bond loans | Maximum | 5½ % |
| Industrial bond loans | " | 5 3/4% |

The Government will seek to maintain these standards rates of interest on which it has based its monetary and credit policy.

The Government has made this attitude known to the representatives of the two banking associations and the life insurance companies association, and is counting on the banks and the life insurance companies to continue their adherence to the standard rates mentioned, and thereby cooperate in preventing a drift of interest rates.

A number of the finance companies not participating in the cooperative credit policy have applied such high rates of interest to both deposits and loans that pressure on the general level of interest rates have resulted. Norges Bank has initiated negotiations with the major finance companies with a view to counteract this trend.

The Ministry of Finance will not approve interest terms for bond issues which deviate from the existing standard levels. It may become expedient, however, to adjust individual bond issues to makret conditions. Furthermore, the rate of interest on building loans with conversion commitment from the Housing Bank will be adjusted to the new rates charged by the Housing Bank on its own loans. Consequently, a rate of interest of 5 percent on such buildings loans will be permitted as against 4.5 percent.

The stimulation of private saving in the form of financial as a preference to real investment is a task of great economic importance. The Government will in the first instance consider what measures other than a raise in the rate of interest may be taken in order to further such a development."

## REFERENCES


1. ALEXANDER, S. "The Effects of Devaluation: A Simplified Synthesis of Elasticities and Absorption Approaches." American Economic Review, XIIX, no. 2, March 1959.

2. BEAN, D. L. "International Reserve Flows and Money Market Equilibrium, The Japanese Case." In Frenkel, J. A. and Johnson, H. G. (eds), The Monetary Approach to the Balance of Payments. University of Toronto Press, Toronto, 1976.

3. BORDO, M. D and CHOUDHRI, E. "The Behaviour of the Prices of Traded and Nontraded Goods: The Canadian Case 1962-74." Paper presented at the Southern Economic Association Annual Meetings, Atlanta, November 19, 1976.

4. COHEN, S. D. The European Community and the General Agreement on Tariffs and Trade. European Community Information Service, Washington, D.C. September 1975.

5. CONNOLLY, M. and TAYLOR, D. "The Monetary Approach to Devaluation and Neutralization: Developed and Developing Countries." Unpublished paper, 1975.

6. CONNOLLY, M. and TAYLOR, D. "Testing the Monetary Approach to Devaluation in Developing Countries." Journal of Political Economy, Vol. 84, August, 1976.

7. COX, M. "Rational Expectations, The Monetary Approach to the Balance of Payments, and the Role of the Monetary Policy in the Open Economy." Unpublished, 1976.

8. COX, M. and WILFORD, S. D. "The Monetary Approach to the Balance of Payments and World Monetary Equilibrium." Unpublished, 1976.

9. DAMMANN, A. "Monetary Policy in Norway." in Holbik, K. Monetary Policy in Twelve Industrial Countries. Federal Reserve Bank of Boston, 1973

10. EIDE, L. Det Norske Penge og Kredittsystem. Norges Banks Skriftserie, no. 1, Oslo, 1973.

11. ERIKSEN, A., JAHN, G., AND MUNTHE, P. Norges Bank gjennom 150 Aar. Norges Banks Seddeltrykkeri, Oslo, 1966.

12. FRENKEL, J. A., AND JOHNSON, H. G. "The Monetary Approach to the Balance of Payments. Essential Concepts and Historical Origins." In Frenkel, J. A. and Johnson, H. G. The Monetary Approach to the Balance of Payments. University of Toronto Press, Toronto, 1976.

13. GENBERG, H. "An Empirical Comparison of Alternative Models of Currency Devaluation," Unpublished, 1974.

14. GENBERG, H. "Aspects of the Monetary Approach to Balance of Payments Theory: An Empirical Study of Sweden." In Frenkel, J. A. and Johnson, H. G. The Monetary Approach to the Balance of Payments. University of Toronto Press, Toronto, 1976.

15 GUITIAN, M. "The Balance of Payments as a Monetary Phenomenon, Empirical Evidence, Spain 1955-71." In Frenkel, J. A. and Johnson, H. G. The Monetary Approach to the Balance of Payments, University of Toronto Press, Toronto, 1976.

16. HELLER. R. H. International Monetary Economics. Prentice-Hall, Inc. Engelwoods Cliffs, New Jersey, 1974.

17. International Financial Statistics, International Monetary Fund, Washington, D.C. (various issues).

18. JOHNSON, H. G. "The Monetary Approach to the Balance of Payments Theory," in Frenkel, J. A. and Johnson, H. G. The Monetary Approach to the Balance of Payments. University of Toronto Press, Toronto, 1976.

19. JOHNSON, H. G. "Towards a General Theory of the Balance of Payments." In Frenkel, J. A. and Johnson, H. G. The Monetary Approach to the Balance of Payments. University of Toronto Press, Toronto, 1976.

20. MADDALA, G. S. Econometrics. McGraw-Hill, New York, 1977

21. MEADE, J. E. The Balance of Payments. London, Oxford University Press, 1951.

22. Statistisk Aarbok. Statistisk Sentralbyraa, Oslo, Norway (various issues).

23. SYRING, E. M. Jr. The Demand for Money in Norway. An Econometric Analysis. Universitetsforlaget, Oslo, 1968.

24. The Kennedy Round Estimated Effects on Tariff Barriers. Report by the Secretary General of UNCTAD, United Nations, New York, 1968.

25. WILFORD, S. D. The Open Economy in a Monetized World: The Mexican Case." Ph.D. Dissertation, Tulane University, 1976.

26. WILFORD, S. D. AND ZECHER, R. "Monetary Policy and the Balance of Payments in Mexico, 1954-1975." Unpublished, 1976.

27. ZECHER, R. "Monetary Equilibrium and International Reserve Flows in Australia." In Frenkel, J. A. and Johnson, H. G. The Monetary Approach to the Balance of Payments. University of Toronto Press, Toronto, 1976.

28. Økonomisk Utsyn over Aaret 1955. Statistisk Sentralbyraa, Oslo, 1955.

29. Økonomisk Utsyn over Aaret 1956. Statistisk Sentralbyraa, Oslo, 1956.

30. Økonomisk Utsyn over Aaret 1957. Statistisk Sentralbyraa, Oslo, 1957.

31 Økonomisk Utsyn over Aaret 1958. Statistisk Sentralbyraa, Oslo, 1958.

32. Økonomisk Utsyn over Aaret 1959. Statistisk Sentralbyraa, Oslo,

33. Økonomisk Utsyn over Aaret 1960. Statistisk Sentralbyraa, Oslo, 1960.

34. Økonomisk Utsyn over Aaret 1961. Statistisk Sentralbyraa, Oslo, 1961.

35. Økonomisk Utsyn over Aaret 1962. Statistisk Sentralbyraa, Oslo, 1962.

36. Økonomisk Utsyn over Aaret 1963. Statistisk Sentralbyraa, Oslo, 1963.

37. Økonomisk Utsyn over Aaret 1964. Statistisk Sentralbyraa, Oslo, 1964.

38. Økonomisk Utsyn over Aaret 1965. Statistisk Sentralbyraa, Oslo, 1965.

39. Økonomisk Utsyn over Aaret 1966. Statistisk Sentralbyraa, Oslo, 1966.

40. Økonomisk Utsyn over Aaret 1967. Statistisk Sentralbyraa, Oslo, 1967.

41. Økonomisk Utsyn over Aaret 1968. Statistisk Sentralbyraa, Oslo, 1968.

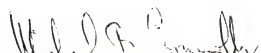
42. Økonomisk Utsyn over Aaret 1969. Statistisk Sentralbyraa, Oslo, 1969.

43. Økonomisk Utsyn over Aaret 1970. Statistisk Sentralbyraa, Oslo, 1970.

## BIOGRAPHICAL SKETCH

Karen Junker Ohldieck was born in 1951 in Norway. She graduated from Arendal Gymnas, Norway, in 1971, with the degree Examen Artium. The same year she entered the College, Agder Distriktshøgskole, where she studied Business Administration. She earned her Høgskolekandidat degree in June 1973. She studied at the same college to December 1973, earning one year's worth of additional credits. In January of 1974, she entered the Graduate School of the University of Florida, Department of Economics. She received her Ph.D. degree in August 1977. Karen Junker Ohldieck was married in 1969 to Merchant Marine Chief Engineer Magne Ohldieck and their son, Martin, was born in 1970.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



Michael B. Connolly, Chairman
Professor of Economics

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Roger D. Blair
Associate Professor of Economics

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

R. Blaine Roberts
Associate Professor of Economics

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Dean Taylor
Associate Professor of Finance

This dissertation was submitted to the Graduate Faculty of the Department of Economics in the College of Business Administration and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

August 1977

Dean, Graduate School